ENGINEERING AND MINING JOURNAL

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MAY 1958

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An Industry Report on . . .

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Enter the fuel cell—converting electrons to electricity. Is it a threat to future lead mining? 89

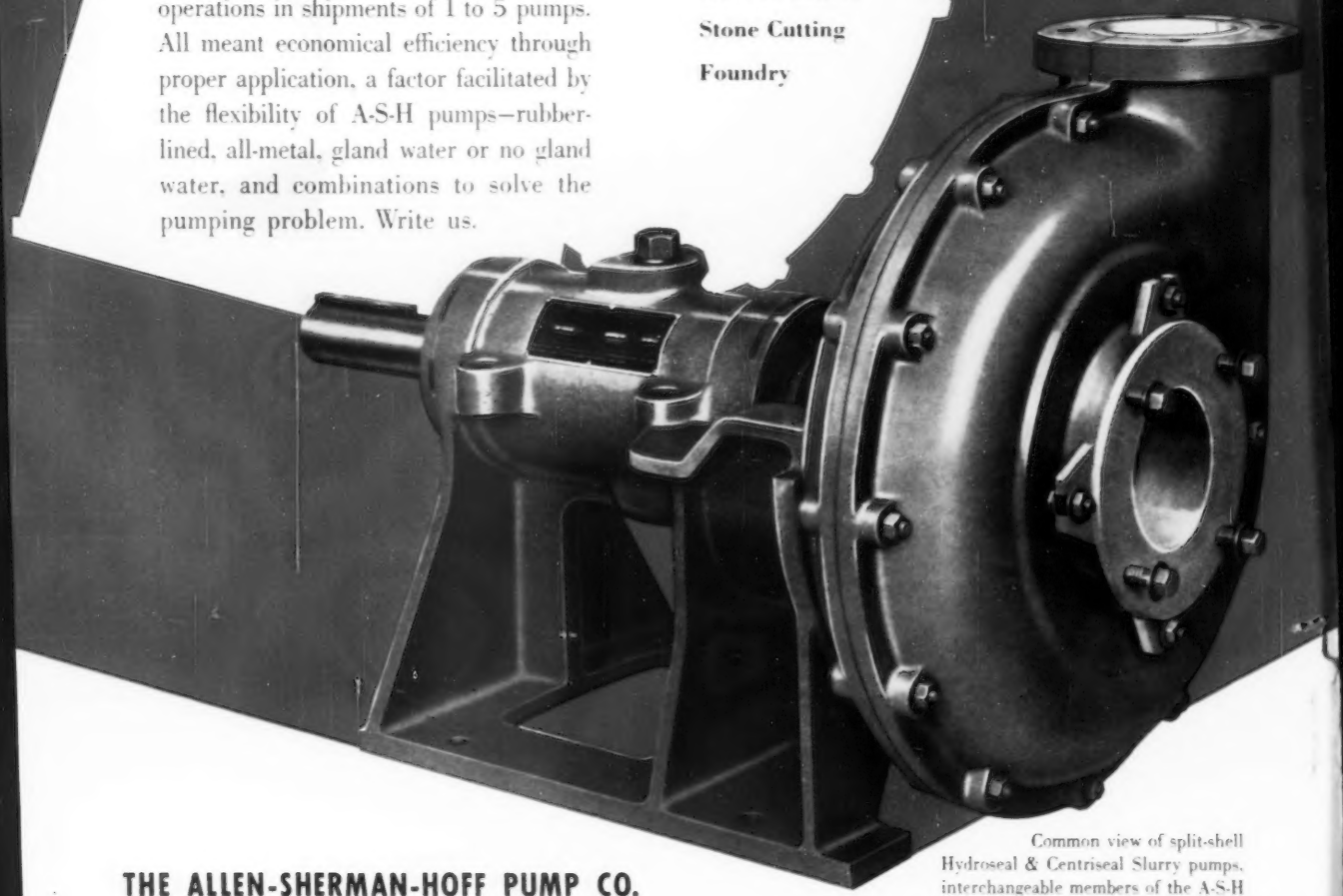
Inside story of A-S-H pumps

for abrasives / corrosives

It isn't only the large "blue-chip" company that makes it a practice to buy quality products. While 44% of A-S-H pumps sold last year were on single orders of 6 to 181 units, 56% went to smaller operations in shipments of 1 to 5 pumps. All meant economical efficiency through proper application, a factor facilitated by the flexibility of A-S-H pumps—rubber-lined, all-metal, gland water or no gland water, and combinations to solve the pumping problem. Write us.

Chief Categories Served

- Uranium Ore
- Copper Ore
- Iron Ore
- Phosphate Rock
- Steel
- Sand & Gravel
- Stone Cutting
- Foundry



Common view of split-shell Hydroseal & Centriseal Slurry pumps, interchangeable members of the A-S-H line, which also includes Hydroseal Sand, Dredge & Sump types for abrasives and corrosives, and Packless pump for acid slurries.

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SAND, SLURRY & DREDGE PUMPS
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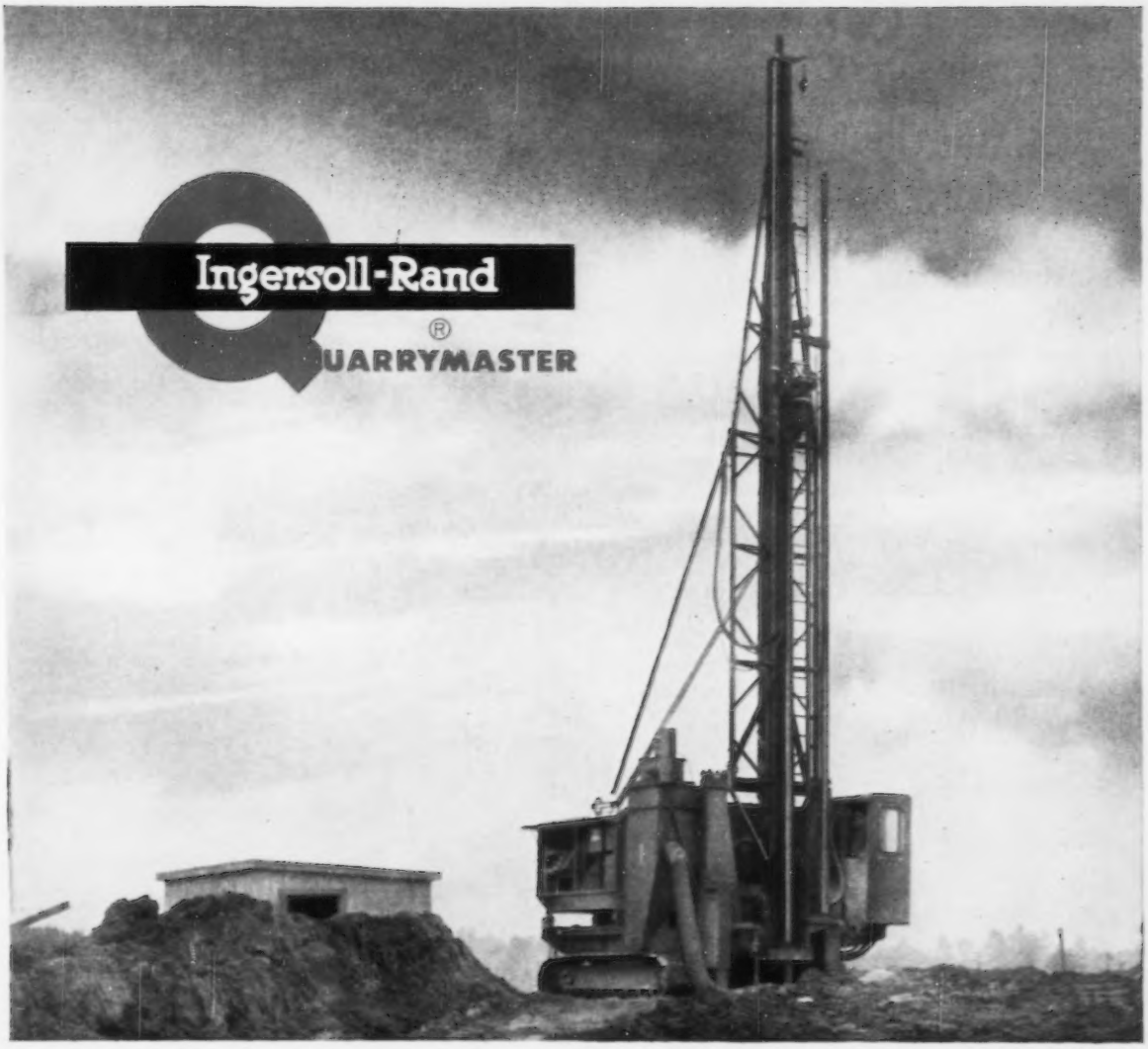

"DOWN THE HOLE DRILL" PERFORMANCE

Results in Two Repeat Orders

An Ingersoll-Rand Quarrymaster in Quebec, Canada, is now at work drilling the extremely hard and abrasive quartzite cap rock formation overlying an extensive magnetite iron ore body. This machine utilizing an I-R DHD-400 "down the hole drill" and 7 inch Carset bits has averaged 15 to 20 feet of hole per hour since the unit went into operation last spring.

Test holes in the Magnetite iron ore indicate that overall drilling speed in the ore will be twice that in the cap rock. In the ore body the face height will be 25 feet.

Based on the performance of the first unit over the past six months, two additional units are now on order. Phone or write your I-R man today requesting full particulars on the high tonnage performance of this and other Quarrymaster installations.

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ENGINEERING AND MINING JOURNAL

92nd YEAR OF PUBLICATION

MAY 1958

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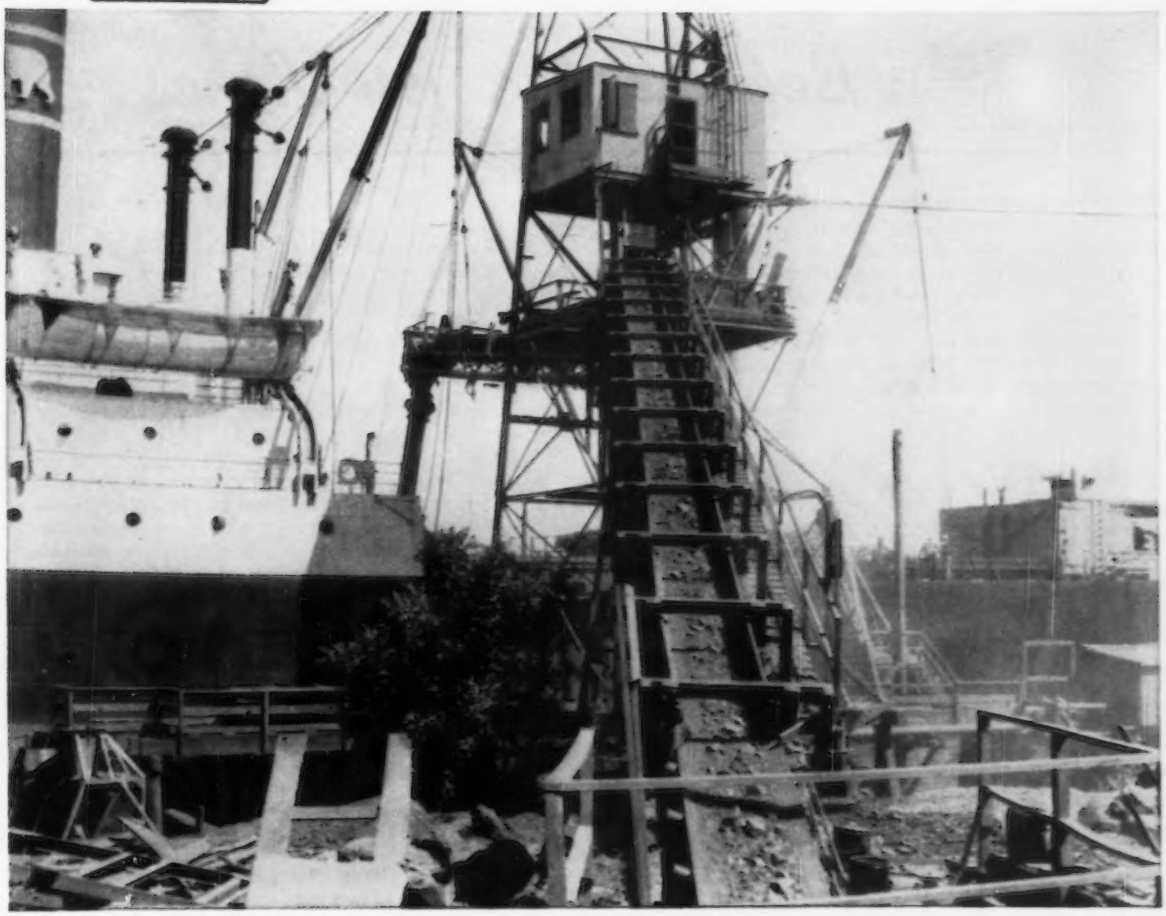
B.F.Goodrich



Iron rushed to sea on a rubber gangplank

B. F. Goodrich improvements in rubber brought extra savings

Problem: That's iron ore being loaded aboard an ocean-going freighter at a 1000-ton-an-hour clip. It costs about $3600 a day to operate a ship like this, so every minute saved in port is vital. The four conveyor belts that haul the ore from railroad cars to ship must keep moving. Stop to repair a belt, and loading would take hours longer while the freighter waited.

What was done: To stand the abuse of heavy chunky loads, sharp cutting edges, crushing impact, engineers recommended B.F.Goodrich Nyfil cord belts. This conveyor belt is made with hundreds of cords, running lengthwise, buried in the rubber. To this is added several layers of Nyfil fabric which gives extra strength to the belt without making it heavy and bulky.

Savings: Trouble-free performance of the B.F.Goodrich conveyor belts has helped make this port the biggest, fastest and most efficient bulk-handling facility on the West Coast. After handling a million tons of material in the first year, the belts showed little sign of wear.

Where to buy: Your B.F.Goodrich distributor has exact specifications for the B.F.Goodrich Nyfil cord belts described here. And, as a factory-trained specialist in rubber products, he can answer your questions about *all* the rubber products B.F.Goodrich makes for industry. *B.F.Goodrich Industrial Products Company, Department M-304, Akron 18, Ohio.*

B.F.Goodrich industrial products

Behind the By-Lines...

Spring has come to the city. — And in the very nick of time. One of the early signs, locally, along with express packages from nurseries being delivered in the suburbs, and neighbors seeding, raking and cultivating, is a quiet restlessness among staff members of the offices of mining companies.

Former field men, now tied to the civilian equivalent of the Navy's LMD (large mahogany desk), suddenly are reminded of mountains unclimbed, trout streams unfished and the musical silence of the Western evening. Lemme tell you, Mac, it ain't all beer and skittles here!

We're running the gamut this month. (We've done it before. In fact, we still hold the P.S. 19 track record for gamut running—2:04.3.)

You're almost sure to find an article exactly to your interest in this Industry Report, which ranges from an on-the-spot survey of a re-birth in mining in Ireland; through manganese milling and uranium processing; to employee housing problems in the North and mining techniques in the Southeast.

And there's lots in between. One little item, starting on p 89, is sure to start you thinking. It concerns the development of the fuel cell, a handy little gadget for converting fuel directly into electric power. We've been answering queries about it ever since word got around that it would appear in this month's issue.

It's getting more and more like the country boy's description of life in New York: "You've gotta run like blue blazes to stay where you are!"

While a lot of publications, including this one, and a lot of industries have been calling for increased research efforts, St. Joe Lead Co. at Bonne Terre, Mo. has gone ahead and done it. The authors wind up their article (which starts on p 85) as follows:

"It is hoped that this brief outline . . . will stimulate the development of similar efforts elsewhere."

At the Wyoming Mining Association meeting (p 128), Gov. Milward L. Simpson told a story defining the difference between a psychotic and a neurotic. The former, he said, was asked, "How much is two and two?" He responded immediately and confidently, "Thirteen." When the neurotic was asked the same question, he was less sure of himself. He said, "I believe it's four," paused, and said, "—And that's what bothers me."

It reminded us of a story used by a scientist to illustrate the difficulties encountered by a new theory when applied to an old problem.

A psychologist was called in by an important executive to help in selecting the most efficient secretary in a field of three.

When the first girl was called in, the psychologist asked only one question, "How much is one and one?" "Two," she replied brightly. "Thank you," said the examiner, and excused her.

The second candidate became a little suspicious, took her time answering and said, "Well, it could be eleven if they were written side by side." She, too, was excused with thanks.

The final examination went briskly as the third gal answered, "One and one added equals two; one times one is one, and if written side by side, the two ones would be eleven."

The psychologist excused her and turned to the executive triumphantly. "Well, which girl would you pick?"

His client slowly leafed through his notes, set them down carefully and said, "I'll take the blonde with the blue eyes."

One of the most unusual mining practices we've come upon in recent years is outlined in the International Mining Series article on p 82. Our good friend Bill Coughlin of the McGraw-Hill London News Bureau volunteered to skitter across the Irish Sea to look at the progress made by some new operators in the ancient mines of Erin.

Bill's first communique, received before his article got here, said, "So we got into the Mercedes-Benz and drove to the working face." We'd thought the mine at Avoca was an underground affair, but assumed that it was now an open pit. That, or friend Coughlin had gotten no closer to Avoca than a Dublin pub and was writing the article free-style.

But, all is now cleared up, and we apoligize for our terrible malignin' suspicions. Darned if the mine isn't underground for a fact, and darned if visitors aren't driven to the face in a Mercedes-Benz. Looking back (gingerly) on some of the trips we've made underground in jeeps and trucks, we'd not be averse to seein' the idea catch on here.

In an industry as broad and diversified as ours, you'll almost always find someone taking on a tough job, and frequently succeeding against the toughest odds.

Our candidate this month for the Upstream Fight Award is South River Mining Co., of Vesuvius, Va., which has taken on the double-barreled opposition of a tough manganese ore and a tough manganese market. The former is being licked by good technology and the latter is being held at bay by a U.S. purchase program. But South River is not leaning on the Government for its future support. Research is under way on future markets for ore and treatment of stockpiled fines. It's an interesting story, and it starts on p 106.

Lounge Lizards, arise! No longer can our T-shirted, muscle-ridden confreres point with scorn at our reluctance to beat our brains (and bones) to powder under a hot summer sun or on frost-bitten ski slopes.

High Court Justice Sir Charles E. Harman, of London, has ruled favorably on the famous Manchester Sportsman's Club case.

The question was whether beer drinking was legally a sport, and therefore untaxable under Manchester ordinance. Cheers and bottoms up, fellow sportsmen, we have met the enemy on his own ground—and won!

Q: WHICH D7 IS THE OLD-TIMER?

This Cat D7 Tractor with No. 7S Bulldozer feeds the grizzly about 450 tons of gold ore a day.

This Cat D7 Tractor with No. 7S Bulldozer, working in heavy wet sand, is building a 2-mile-long dike.

A: If you know your Cat Diesel Tractors, you've spotted it on the left. It's 12 years old. With the new D7 and a D8, it's used by the London Extension Mining Co. in an open pit mining operation 30 miles from Beowave, Nevada. The climate's rugged. Temperatures range from −20° to 110°.

Q: What does the company think of the machines?

A: It has had Caterpillar-built equipment since 1936. General Superintendent R. B. Warmbrodt says: "We find the tractors are rugged and stand up well."

Q: How are the machines used?

A: Generally one is kept in the pit cleaning up around shovels, while the other feeds the grizzly 450 tons of ore a day. The machines also strip overburden, handle tailings and knock down dump piles from trucks at the stockpile. Two months a year, the new D7 builds about 2 miles of dike to control tailings. The machines are on duty 7 days a week all year 'round.

Q: How do the D7s compare in production?

A: Good as the old D7 is, it's not in the same league with the modern, heavy-duty D7. Of course, that's to be expected. Caterpillar constantly builds improvements into its machines. The new D7 is more powerful, easier to operate and more rugged. For example, among many modern features, it has the oil clutch that delivers 1,500 hours without adjustment.

Q: Has the company any other Caterpillar equipment?

A: Yes. Two engines in shovels and two in compressors. Mr. Warmbrodt says: "Since we're far from supply, we find the parts interchangeability of Caterpillar units a decided advantage. We also get excellent service from our Caterpillar Dealer!"

Add all this up and you get some of many reasons why it will pay you to use a Cat Diesel Tractor on your operation. You can't beat the combination of rugged machines, parts availability and good dealer service. Ask your Caterpillar Dealer to give you the low-down on the new D7's high productive capacity. Better still, watch one work—ask him to demonstrate on your job!

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

CATERPILLAR

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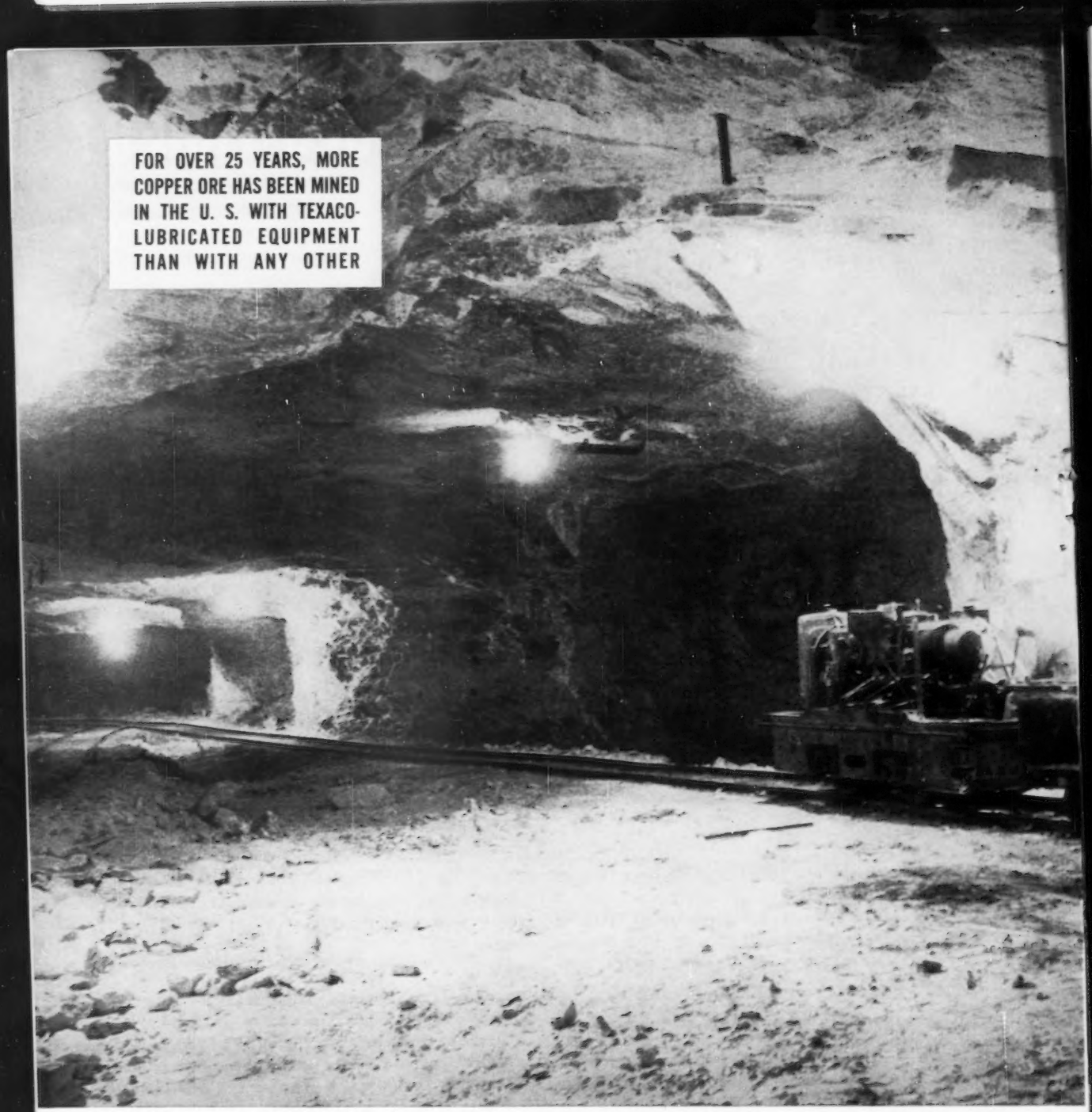
FOR DEPENDABLE PRODUCTION USE RUGGED CAT DIESEL TRACTORS



Get "springtime starts" all year round

TEXACO OLYMPIAN GREASE won't thick up in winter, thin out in summer—gives trains the same easy starts 12 months a year

You don't have to strain your engines getting trains started on a cold winter day—or worry about grease oozing out in summer. Special properties of Texaco Olympian Grease keep it at the right consistency all the time. Furthermore, it has a high resistance to oxidation, and won't separate in service or in storage. It's bound to give longer life to your bearings.

For your wire rope and open gears, use Texaco Crater or (for spray application) Texaco Crater X Fluid. They protect both strands and core, keep wire rope strong longer. They cush-

ion shocks and permit heavy loads, prolong open gear life.

Let your local Texaco lubrication representative show you how Texaco products can help lower your maintenance costs. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write to:

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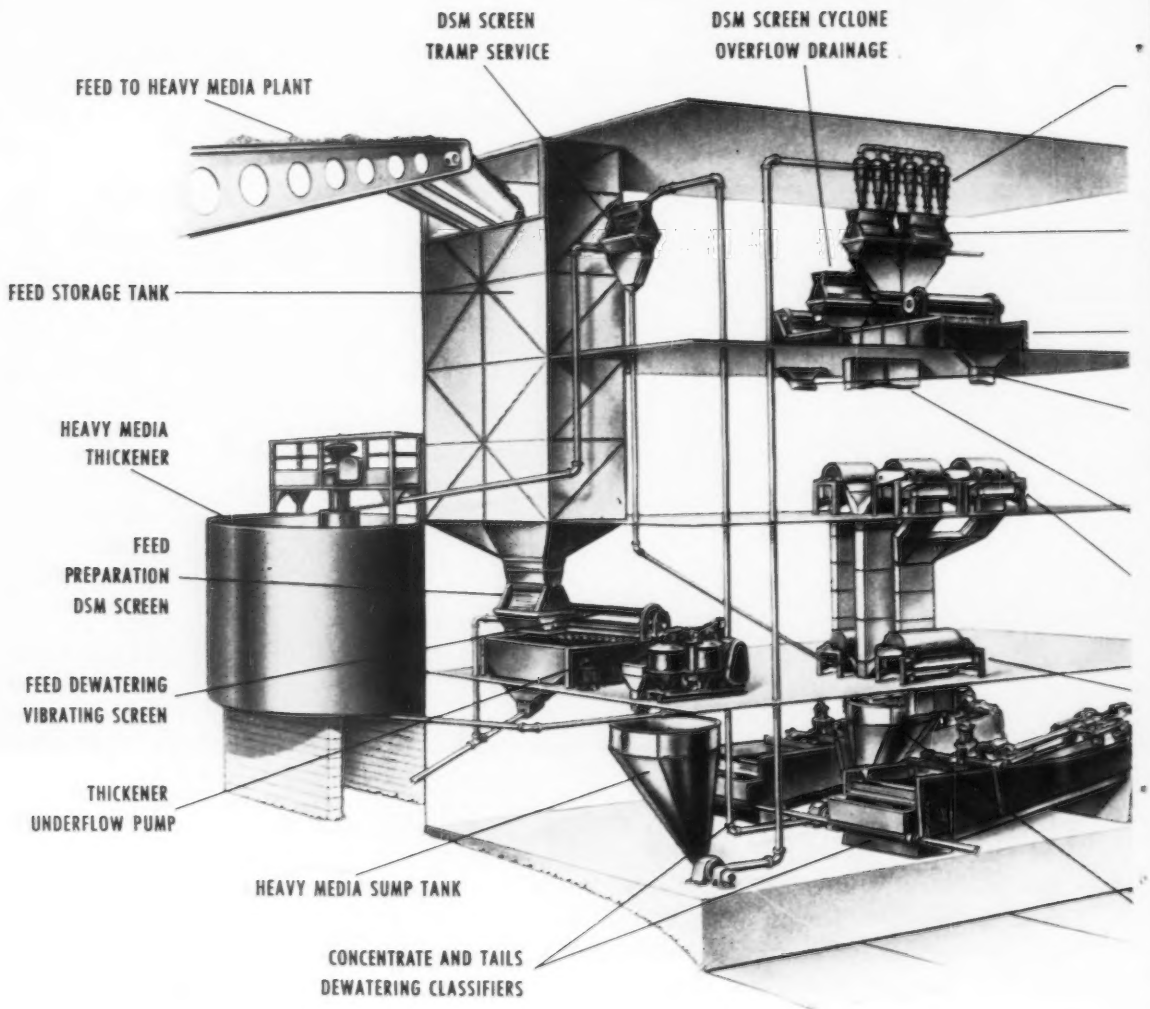
for improved cyclone media plant operation



TYPICAL CYCLONE HEAVY MEDIA PLANT

heavy

THE DORR-OLIVER DSM SCREEN

HEAVY MEDIA CYCLONES

DSM SCREENS
CYCLONE UNDERFLOW DRAINAGE

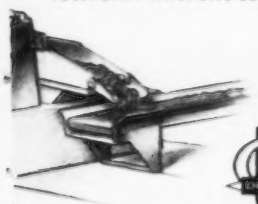
WASHING SCREENS

CONCENTRATE AND TAILS TO
SECONDARY MAGNETIC SEPARATORS

DILUTE MEDIA TO
PRIMARY MAGNETIC SEPARATORS

PRIMARY MAGNETIC SEPARATORS

SECONDARY MAGNETIC SEPARATORS



DILUTE MEDIA SUMP TANK

One of the most significant new tools for the mining industries is the Dorr-Oliver DSM Screen. The marked superiority of the unit for high capacity wet screening of materials in the 8-100 mesh range has been proven by exhaustive development and test work and in numerous fields of commercial application.

For the cyclone heavy media plant operator, application of the DSM Screen results in improved overall plant operation —

First — Applied to feed preparation, the unit eliminates fines which contaminate media and lead to higher magnetite losses.

Second — For screening of magnetite from cyclone underflow concentrate and overflow fractions, the unit reduces the amount of media sent to the cleaning circuit to a minimum, consequently considerably reducing magnetite losses.

Third — On tramp service the unit prevents foreign oversize material from entering the heavy media storage tank.

You'll want to know more about the DSM Screen. For complete information, write for a copy of Bulletin No. 2300. Dorr-Oliver Incorporated, Stamford, Conn.

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How AAF Licked the COPPER Dust Problem

Type N ROTO-CLONE

Type W ROTO-CLONE

AAF controls copper dust at thirteen mines

The copper industry was one of the very first to improve industrial and employee relations with modern dust control. The major dust-producing operations—crushing, milling, bucking room, sample mill—are now dust-free, thanks to AAF's wet-collecting Type N and Type W ROTO-CLONES.

The Type N combines centrifugal force with the thorough intermixing of water and dust-laden air. The Type W combines dynamic precipitation with dust-trapping water sprays—uses a minimum of water for sluicing the collected dust. Both offer (1) small space requirements, (2) maintained performance, (3) constant exhaust volume, and (4) high collection efficiency.

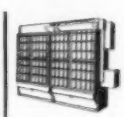
Take a tip from copper—call your local AAF representative or write direct for Type N ROTO-CLONE Bulletin 277.

AAF herman nelson

American Air Filter COMPANY, INC.

193 Central Avenue, Louisville 8, Kentucky
American Air Filter of Canada, Ltd., Montreal, P. Q.

AAF Dust Control Equipment



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Look for this nearby Goodyear dealer sign – for better tire values – better tire care.

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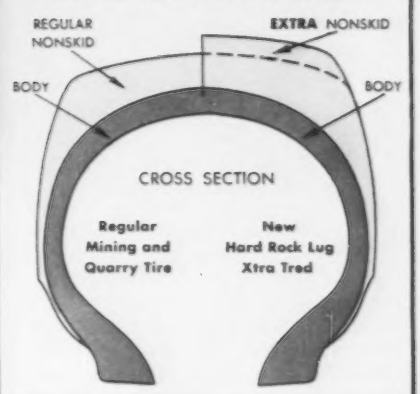

GOODYEAR ANNOUNCES THE

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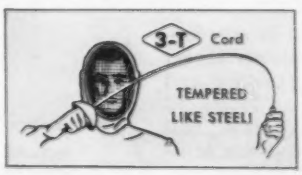
It's the new Hard Rock Lug XTRA TRED–with as much as 18% more tread rubber, *by actual weight*–delivering up to 50% more tread life. *And* that extra rubber is a new, *tougher* formula that holds tread cuts to new LOWS.

You'll find extra muscle all through this tire: bigger, reinforced lugs, burlier shoulders, stouter sidewalls–and TRIPLE-TOUGH 3-T NYLON CORD, the greatest tire *saver* in 23 years!

Let the new Hard Rock Lug XTRA TRED square off against your toughest tread-wear problems. It's a great, new tire–born and built to soften up the toughest going! Goodyear, Truck Tire Dept., Akron 16, Ohio.



Like steel, tire cord must be tempered to be tough. Goodyear's exclusive 3-T process, involving Tension, Temperature and Time, triple-tempers cord to make it TRIPLE-TOUGH–to give you longest tire life, lowest cost-per-yard!

GOODYEAR

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Xtra Tred – T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

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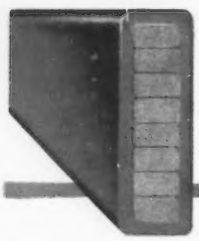
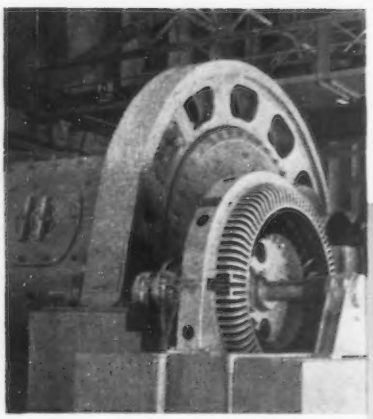


Super-Seal...

motor with void-free insulation

New motor withstands abrasion, physical stresses, moisture, heat aging...

revolutionizes motor protection practices in mining industry



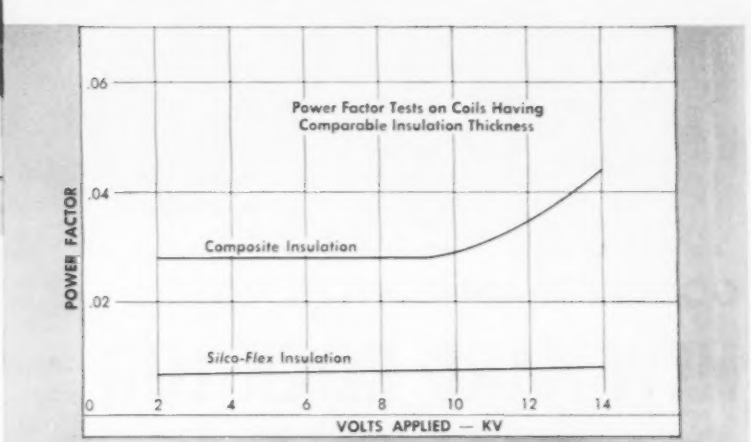
Remarkable new insulating systems combined with advanced mechanical features provide a completely new concept in motor protection — the *Super-Seal* motor. This revolutionary new motor gives you complete protection from moisture, abrasives and contaminants, even with so-called drip-proof motor enclosures.

New motor is protected with:

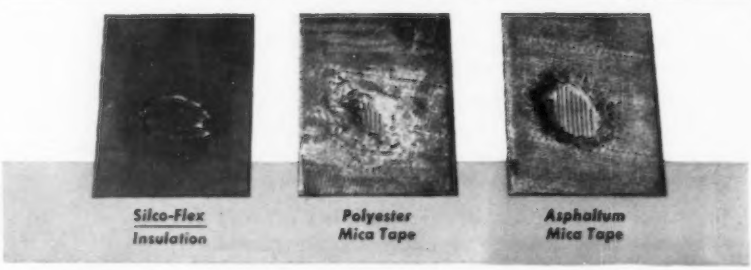
Silco-Flex stator coil insulating system. A homogeneous, void-free dielectric barrier of vulcanized silicone rubber possessing a resistance to abrasives and most corrosive or chemical atmospheres. So moisture-proof it can be hosed down for cleaning.

Integrated field coils in synchronous machines are completely sealed against contaminants, bonded and locked against mechanical forces.

For additional information, call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.



The void-free nature of *Silco-Flex* insulated coils is demonstrated by power factor tests on *Silco-Flex* and composite insulations. Sharp rise in power factor of composite insulation above 9 kv is result of ionization of voids.



Note difference in abrasion! Insulation shown after sandblasting for one minute with 90-grit aluminum oxide and 100-psi air from distance of six inches.

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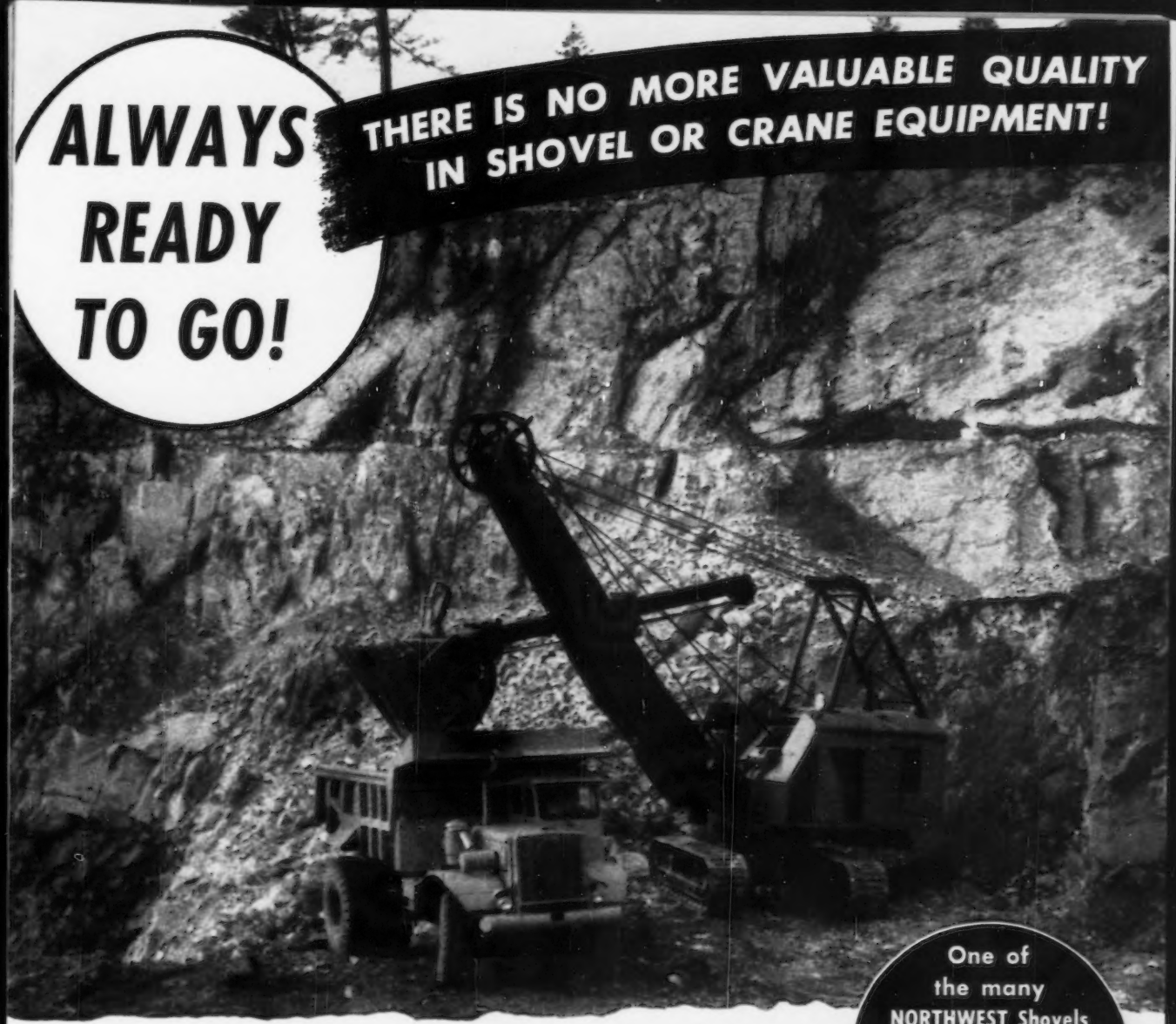
THERE IS NO MORE VALUABLE QUALITY IN SHOVEL OR CRANE EQUIPMENT!



One of the many NORTHWEST Shovels handling Iron Ore. This 80-D is in Texada Mines, Vancouver, B. C.

No other single advantage of Northwest equipment has resulted in so many repeat orders. Your Northwest is always ready to go! *We hear it everywhere and Northwests users will tell you so.*

Northwest dependability is a direct result of Northwest design. Power is brought to the action by the most direct route. Machinery Bases and Machinery Side Frames are heat treated cast steel to take the shocks of digging. Parts and assemblies are ruggedly built and heavy enough for the job to be done. The simple "Feather-Touch" Clutch Control brings ease of operation and is free from compressors, valves, tubing and other delicate mechanisms. The Helical Gear Drive, the Cushion Clutch, Uniform Pressure Swing Clutches not only play a part in better output but they combine in smooth, trouble-free operation to *assure performance when it is needed.*

Your Northwest is *always ready to go!* There is no more valuable quality in Shovel or Crane Equipment. You can buy it in a Northwest.

NORTHWEST ENGINEERING COMPANY

1509 Field Bldg., 135 South LaSalle Street, Chicago 3, Illinois

NORTHWEST

Convertible for any Mining Material Handling or Excavation Problem

Always Ready to GO

NORTHWEST EQUIPMENT IS BUILT IN THE FOLLOWING SIZES

SHOVELS	CRANES	DRAGLINES	PULLSHOVELS	TRUCK CRANES
¾ Yd. to 2½ Yd. Capacity	13-Ton to 50-Ton Capacity	¾ Yd. to 3 Yd. Capacity	¾ Yd. to 2½ Yd. Capacity	25-Ton and 35-Ton Capacity

5-80-58-IC

Ever see tougher operating conditions?

Tiger Brand Amerclad is made for this treatment

ON THE TRACK-TAMPING MACHINE shown here, the cable is flexed 4,500 times per minute. Eight powerful vibratory motors are used to drive eight tamping assemblies. Each motor is powered with Tiger Brand Amerclad cable.

It wasn't always that way. Other cable did a good job—for a while. But the shattering vibration actually caused the jackets to peel away from the conductors. Then Amerclad, with its dynamically balanced conductors and tough, lead-cured jackets, solved the problem. In fact, the manufacturer says, "Tiger Brand is superior to anything we have ever seen for this type of service. It is completely dependable under all conditions."

For an interesting contrast, look at the power shovel pictures, and the three-inch diameter Amerclad. It's the same kind of cable used on the track tamper, only bigger and with more conductors. Operating conditions are different, though. Some of the cable is right in the blast area where it is dragged over sharp rocks and pounded by dynamite-propelled boulders. The cable operates 24 hours a day at temperatures that range from 100° in the shade to minus 40° in shoulder-deep snow.

When you specify Tiger Brand Amerclad, this is the quality you get. We make no second- or third-grade line. *All* Amerclad is made to the same exacting specifications—designed for users who demand the very best because they can't afford expensive down time. Why not call your American Steel & Wire salesman and ask for more information about this quality cable?

USS, American, Tiger Brand and Amerclad are trademarks

Notice the long span of the cable bridge and the extreme flexibility of the Amerclad in the foreground. It's the same cable.

Railroad track tamper is a completely self-contained unit. Notice the eight cables which feed separate vibratory motors.

This is a typical power shovel at the mine. The Amerclad runs along the ties and under the tracks.

Tiger Brand Electrical Wire & Cable

a standard Tiger Brand cable for every special job!

Asbestos Wire and Cable • Mold Cured Portable Cord • Shovel & Dredge Cable • Paper & Lead Cable • Varnished Cambric Cable
Interlocked Armor Cable • Special Purpose Wire & Cable • Aerial, Underground and Submarine Cable

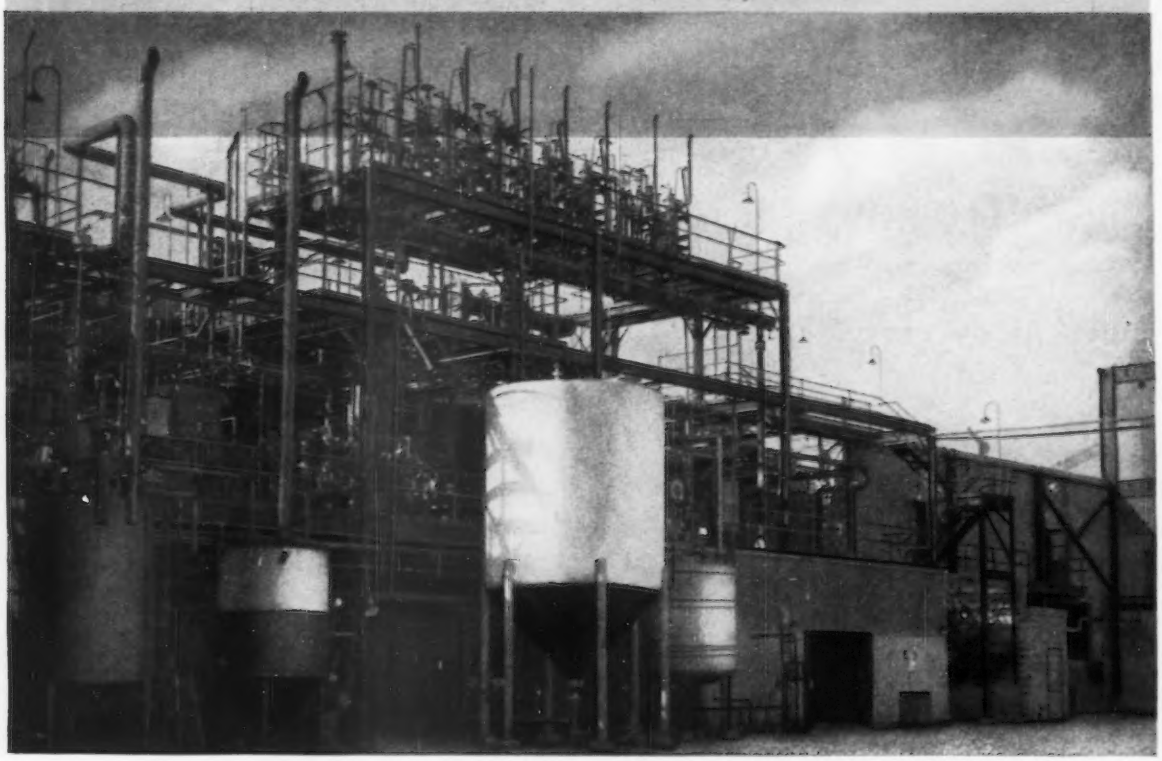
American Steel & Wire
Division of **United States Steel**

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors • Tennessee Coal & Iron Division, Fairfield, Ala., Southern Distributors • United States Steel Export Company, Distributors Abroad

new chemical plant
DESIGNED AND BUILT IN JUST SIX MONTHS

Undivided responsibility for engineering, procurement and construction services enabled CATALYTIC to build a new, operating chemical plant in just six months!

This unique performance called for precise coordination between the client and the contractor—to CATALYTIC, this project was a welcome opportunity to meet the challenge of on-time, on-budget performance . . . to show SKILL, EXPERIENCE and IMAGINATION at work.



CATALYTIC
CONSTRUCTION COMPANY

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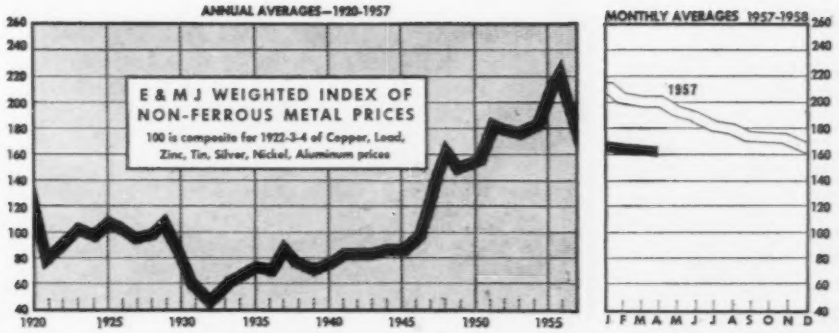
In Canada: Catalytic Construction of Canada, Limited; Sarnia, Ontario; Toronto, Ontario; Montreal, Quebec

Catalytic *On-Time...On-Budget* Services for the metallurgical, chemical, petrochemical and oil refining industries: Project Analysis; Process Development; Process Design; Economic Studies; Engineering; Procurement; Construction.

E&MJ OUTLOOK

PRICES


ANNUAL AVERAGES—1920-1957
E & M J WEIGHTED INDEX OF NON-FERROUS METAL PRICES
100 is composite for 1922-3-4 of Copper, Lead, Zinc, Tin, Silver, Nickel, Aluminum prices
MONTHLY AVERAGES 1957-1958
1957
J F M A M J J A S O N D

MARKETS

Lower prices for lead, tin and aluminum in April offset a slight gain in copper, resulting in a net decline of the E&MJ metal price index from 167.31 for March to 165.00 for April.

American Zinc Institute will station a full-time technical representative in the Detroit area to promote, educate and follow trends related to the use of die castings in the automotive industry and other fields.

●

AT HOME

Capital goods producers, cooperating in the quarterly McGraw-Hill Machinery New Orders Forecast expect new orders to pick up in the current quarter and continue to go up throughout 1958. A 13% gain is expected in the dollar volume of new orders from the first quarter of 1958 to the first quarter of 1959.

Production of tantalum should increase from 800,000 units in 1957 to 2-million units in 1958, and to 8-million units by 1960, according to a survey reported by Aries Associates, consultants to chemical industries.

Leading ceramics to be used in missile manufacture include aluminum oxide, boron nitride, molybdenum disilicide, magnesium oxide, aluminum carbide, zirconium oxide and beryllium oxide.

Inventory liquidation by steel users should end in a month or two, according to Avery C. Adams, president, Jones & Laughlin Steel Corp. He predicted steel industry operations at 55% of capacity for the second quarter of 1958, 65% for the third quarter, and 75% for the fourth quarter.

●

LABOR

International Union of Mine, Mill and Smelter Workers, in deference to its Canadian membership, announced late in April that it was "appalled at the quota proposal of three Tariff Commission members which made no distinction between low-wage and high-wage countries, and which would be 'disastrous' to a country like Canada, our largest customer for U.S. produced goods."

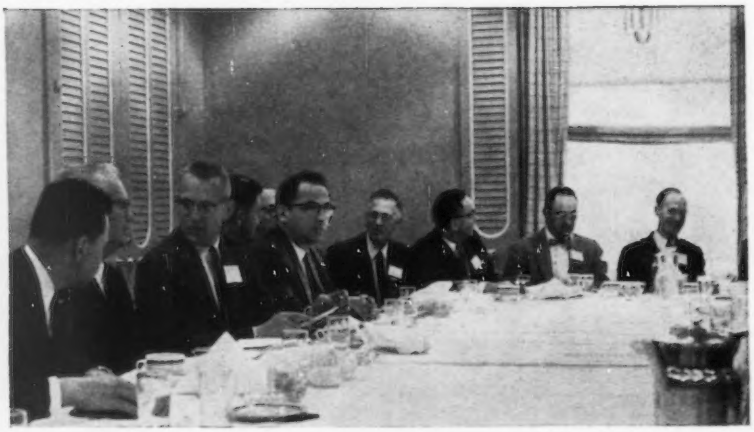
●

ABROAD

Capital expenditures of International Nickel Co. were $23-million in 1956, $43.9-million in 1957, and are expected to run between $60- and $70-million for 1958, according to a report to shareholders by Dr. John F. Thompson, chairman of the board.

Wabush Iron Co. now has controlling interest in Newfoundland and Labrador Corp. which has mineral and timber concessions for over 24,000 square miles in Labrador and Newfoundland. Wabush Iron is owned by Pickands Mather & Co., The Steel Co. of Canada, Ltd., Youngstown Sheet and Tube Co., and Interlake Iron Corp.

ARRIVING at the hotel—Philip Bradley, left and Dr. Ian Campbell chat.



INDUSTRY speakers who delivered papers at the conference were guests of the planners. Papers covered exploration, beneficiation as well as assays and markets.

MEETING before breakfast—Fred Lohse, chairman (left) jokes with Newell Appleton (center) and J. B. Newsom, programming.

CHECKING in at the registration desk—John N. Butler, Nevada U., Victor Howard (Manganese Inc.) and L. K. Wilson.

San Francisco Minerals Conference

ALMOST 400 REPRESENTATIVES of various segments of the mining industry gathered in San Francisco March 27, 28 and 29, 1958 for the Pacific Southwest Mineral Industry Conference of the American Institute of Mining, Metallurgical and Petroleum Engineers. San Francisco AIME section sponsored the meet, with the Southern California, Reno and Las Vegas sections as co-sponsors.

AIME members from seven western states—California, Nevada, Arizona, Idaho, Washington, Oregon and Utah —were invited to the conference.

Fred Lohse of Kaiser Aluminum & Chemical Corp., Oakland, acted as general chairman for the conference. He was aided by L. K. Wilson, Asarco, San Francisco, chairman, general arrangements; J. K. Brooke, Kaiser Aluminum & Chemical Corp., chairman, program; W. I. Watson, Arthur D. Little, Inc., San Francisco, chairman, registration; O. E. Duling, Calaveras Cement Co., San Francisco, chairman, space and properties; and Mrs. E. M. Barker, chairman, ladies' activities.

Two state of California officials were luncheon guest speakers—DeWitt Nelson, director of natural resources, whose topic was "The Importance of the Minerals Industry," and Harvey O. Banks, director of the state department of water resources, who stressed the need for a statewide concept of California's water problems in his talk on the California Water Plan.

Technical sessions were split up into three divisions: geology, industrial minerals, and extractive metallurgy.

Electron Beam Melting

A highlight of the extractive metallurgy sessions was a talk on columbium metallurgy by Dr. Charles D'Ancona Hunt, manager of Stauffer-Temescal-Mallory Sharon's joint venture melting project, Berkeley, Calif. Said Dr. Hunt: "Recent developments in metallurgical techniques peculiar to columbium largely eliminate those expensive aspects of the processing steps that separately or in combination keep the prices of titanium, zirconium and tantalum too high for their ultimate widespread use."

Columbium can be purified as cheaply as a metal, he said, by the electron beam melting process, which converts raw reduction product from sponge or powder into "an absolutely sound and ductile ingot ready for fabrication." It's as workable as gold or silver. Columbium monoxide and nitrogen evaporate relatively fast from molten columbium metal in high vacuum while the metal itself evaporates slowly, with the result that the metal is purified in the process of being converted from sponge or powder to solid ingot.

Potential markets for columbium, he said, are:

1) Pure metal in sheet, foil or tube form, for atomic energy, chemical industry, electronics, and marine use, where its nuclear properties, high temperature strength in inert atmospheres or corrosion resistance are of importance. Further uses should develop from fact that it can be worked into complex shapes and hardened by surface oxidation and vacuum annealing.

2) Pure columbium as a base for high-temperature oxidation-resistant alloys for use in gas turbine engines—in military applications at present prices and ultimately in civilian use.

3) An alloy additive to other metals such as iron, used as base material, as in the 90% uranium 10% columbium alloy for nuclear fuel elements.

(*Continued on page 198*)

Mining Calendar

34th Annual conference, Lake Superior Mines Safety Council, Allen D. Look, 329 Federal Bldg., Duluth, Minn. May 22 and 23

Colorado Minerals Beneficiation Subsection, Society of Mining Engineers, AIME, Colorado Springs, May 24

3rd Reactive Metals Conference, Niagara Frontier Section, AIME, Statler Hotel, Buffalo, N.Y., May 27-29

Central Appalachian Section, AIME, Phoenix Hotel, Lexington, Ky., June 13-14

13th Purdue Industrial Waste Conference & Exhibit. Convention Hall, Philadelphia, Pa., Sept. 15-19

Rocky Mountain Minerals Conference, AIME, Salt Lake City, Sept. 17-19

7th National Clay Conference, U.S. National Museum, Washington, D.C., Oct. 20-23

Mid-America Minerals Conference, Society of Mining Engineers, AIME, Chase-Park Plaza Hotels, St. Louis, Oct. 23-25

Metallurgical Society of AIME Fall Meeting, Detroit, Mich., Oct. 27-30

(*This Month continues page 126*)

As We Went to Press . . .

Interior Department's new five-year subsidy plan for domestic producers of copper, lead, zinc, acid-grade fluorspar and tungsten is likely to put on ice for another year the controversial question of federal long-range mining aid.

Presented to Senate Interior Committee, April 28, the long-awaited proposed revision to last year's Seaton Doctrine surprised mining-state Senators by going further than they had expected. It would set price levels for each commodity, authorizing the department to make up the difference between them and market prices within set quantity limitations on each commodity. The prices and amounts are: 1-million tons of copper at 27½c per lb; 350,000 tons of lead at 14¾c per lb; 550,000 tons of zinc at 12¾c per lb; 180,000 tons of fluorspar at $48 per short ton; 375,000 short ton units of tungsten at $36 per unit. First year costs would be $161-million, Interior estimates, with lesser payments necessary in the remaining four years if the plan were successful in stabilizing domestic markets.

This support is more than the package of production bonus, purchase and tax aids the committee anticipated. But it contains no proposed import tariff boosts, and the price levels are well below what producers have been seeking as minimum break-even points. Further, it is doubtful Congress will approve the $160-million outlay in new money this year.

At the same time, the promise of a new aid program figures to weaken producers' drive for specific commodity quota amendments to the reciprocal Trade Agreements Act extension bill. Mining-state Senators will be under new pressure to vote for a compromise one-year trade extension bill in return for consideration of the subsidy law. Further, the subsidy proposal may provide new arguments against the tariff commission recommendations for lead-zinc duty increases.

Major executive changes were announced at month's end by Anaconda and Asarco. Clyde E. Weed was named chairman, Charles M. Brinckerhoff, president, and C. Jay Parkinson a vice president of Anaconda.

Norbert F. Koepel was elected vice president of Chile Exploration Co. and Andes Copper Mining Co., and Richard S. Newlin, director of Greene Cananea Copper, Chile Copper, Chile Exploration Co., and Andes Copper Mining Co.

At American Smelting & Refining Co., J. D. MacKenzie, vice president for smelting and refining operations, was named president of the company, succeeding R. Worth Vaughan, who was named vice chairman. R. L. Jourdan was also elected to the post of vice president.

Homestake-New Mexico Partners dedicated its 750 tpd uranium mill at Grants, N. M., April 26. Operation of the property began in February on Dysart mine ore stockpiled at the plant site during the construction period. Plant will also take ore from the Partners mine, like the Rio de Oro's Dysart, located at Ambrosia Lake.

Utah Copper division of Kennecott Copper Corp. has awarded a contract for construction of a $16-million, 75,000-kw addition to the present 100,000-kw steam-electric plant near the Magma mill at Salt Lake County, Utah.

WASHINGTON IMPACT

Highlights

WONDROUS WAYS—Washington is juggling its nonferrous metal-mineral policy problems with a dexterity that puts the Harlem Globetrotters' basketball handling magic in the amateur class. The difference is that the Globetrotters are a team—they know what they want to do with the ball ahead of time, and agree on where to pass it.

TAKE LEAD-ZINC RELIEF, FOR EXAMPLE. Proposals have been ricocheting between the White House, Office of Defense Mobilization, Interior Department, Tariff Commission and Congress since 1954. First the tariff agency recommended higher import duties; the President said "no", but told ODM to start an incentive purchase program. As this was running out last summer, Interior agreed to higher tariff legislation, Congress said "no". The President said go back to the Tariff Commission, and now the Commission says "yes" and "yes, but . . ." in its split 3-3 findings on the extent of proposed tariff boosts and quotas (see right.)

Now the President has the tariff hot potato back in his lap, while Congress is divided on the tariff question and Interior Secretary Fred Seaton, has included these metals in his new five-year subsidy plan (see p 19), just as incentive stockpile purchase programs have run out.

Seaton's move, with White House backing, may provide a strong argument against approving tariff boosts pending Congressional approval of the subsidy plan. But Congress is not likely to approve the subsidy plan, this year at least, because of the new money outlay involved.

Meanwhile, the subsidy proposal may help pave the way for passage of a compromise extension of the Trade Agreements Act (see below), by holding out an alternative solution to import quotas, which the President opposes.

COPPER—IS IN A SIMILAR BOAT. Except for eight months during the Korean conflict, Congress has suspended import tariffs since World War II. The suspension runs out next month, and Congress is in no mood to extend it. So Seaton has backed a Senate proposal to kill the suspension that is scheduled to die anyway. And he opposes other bills to raise both the duty and peril point on copper imports.

But again, Seaton is leaving the door open for the subsidy program, which also would include copper. In this case, that promise may forestall a Tariff Commission action on copper similar to the one on lead-zinc—if and when copper producers file a similar petition.

LONG-RANGE POLICY—Seaton, in effect, is offering only the promise of subsidy payments if and when Congress approves them. He is opposed to wide-scale incentive purchase stockpiling revivals as proposed by Sen. Mike Mansfield (D-Mont.) to cover all metals under the old P. L. 733 as well as copper, lead and zinc.

This tosses the whole question of long-range mining support back to Congress, where it is up against divided opinion over both tariff policy and subsidy programs.

TRADE COMPROMISE—Mining-state pressure for commodity quota amendments to the Reciprocal Trade Agreements Act extension bill will be stronger in the Senate than in the House. But it will be up against an attractive compromise: a straight one-year extension of the existing trade law—without any new tariff-cutting authority and without further protectionist amendments.

This deal, if it can be sold to protectionists and freer traders alike, would shelve the whole trade issue for another year.

ALPHABET SOUP—If Congress doesn't disapprove, a new unified agency—Office of Defense and Civilian Mobilization—will replace ODM and Federal Civil Defense Administration next month. But the new letters mean only that overlapping policy and administrative functions will be put under one roof. No change in metal-mineral policy will be made, except that the merger underscores the new emphasis on civilian, rather than military, mobilization requirements now that metal-mineral stockpiles are nearly filled.

Tariff Commission Report Cites Metal Quota Hazards

THE TARIFF COMMISSION'S escape clause report on lead and zinc is a precedent-setter. It is the first time in the agency's history it has split so violently over what relief should be granted. It is the first time members have recommended both maximum import duty boosts and quota limitations as well. On the other side, it is the first time Commissioners have argued so specifically and to the point against the practical effects of quotas. It is a decision which will be hashed over and cited for many years to come for its implications in future cases.

The Commission split along strict party lines on the tariff-quota issue. The three Republican members—chairman Edgar Brossard, vice-chairman Joseph Talbot, and Walter Schreiber—supported tariff hikes back to the 1930 rate level plus quotas. The three Democratic commissioners—Glenn Sutton, Weldon Jones, and William Dowling—advised smaller tariff boosts of 50% over the 1945 rates and argued vigorously against quotas.

The President must make the final decision by June 23, after getting the views of his newly formed cabinet-level Trade Advisory Committee. He is expected to choose at least the lower tariff increases, possibly the higher ones, and reject the quota recommendations.

The GOP half of the agency proposed these new import duty rates:

On lead and zinc ores and concentrates or "unmanufactured" items, a flat tax of 1.8c per lb; on lead metal, a 2.55c per lb duty; and on zinc metal, a 2.1c per lb duty.

The Republican trio proposed annual quotas of 221,700 short tons of unmanufactured lead, and 325,600 short tons of unmanufactured zinc.

The Democratic members, concurring in the finding of injury from import competition, recommended new rates of 1.5c per lb on lead and zinc ores and concentrates, 2.125c per lb on lead metal, 1.75c per lb on zinc metal.

The Democrats concurred in a finding that import competition is injuring domestic producers, and the Republicans softened their recommendations by stating they don't think tariffs and quotas are the entire answer to domestic producers' economic problems.

But the strongest language is to be found in the section where Sutton, Jones, and Dowling argue against the imposition of quotas. It is a departure from the usual commission anti-quota argument that these trade curbs are rigid and therefore unworkable.

In addition to that argument, the Democrats flatly predicted that the imposition of quotas would lead to Government regulation of the industries concerned. They also said quotas would cause discrimination between user-customers, and force some smelters out of business. Further they argued that the higher tariff boosts, let alone quotas,

would work against the domestic industries they are designed to protect by creating artificially high U.S. price levels which would attract further importations.

Late Developments

THE GOVERNMENT'S Cuban nickel production plant operations are under fire again. A House Government Operations Subcommittee headed by Rep. Jack Brooks (D-Tex.) took its second look in as many years into Office of Defense Mobilization policy on management of the Nicaro plant late last month.

The Subcommittee, eager to find fault with the Administration's handling of nickel policy, sought to discredit the 1956 incentive purchase contract awarded Freeport Sulphur Co. to supply Nicaro, and also sought to find out why Nicaro has not yet been sold to private interests.

Government officials and Freeport spokesmen have justified the purchase contract on grounds of the then-short world nickel market which has since taken on a bullish cast and caused some economists to predict a glut of the metal by 1962-65. But both Defense Mobilizer Gordon Gray and GSA administrator Franklin Floete have admitted under sharp questioning that the royalty provisions and 74c market price obligated to Freeport may have been too high.

Delay of the Nicaro sale has been attributed to Cuban political instability and hesitation of potential owners to buy into a burgeoning market.

At last month's House hearings, the committee heard charges that Freeport had hired a private investigator to check into the personal life of GSA's special Nicaro officer, Ira D. Beynon.

INTERNATIONAL COMMODITY AGREEMENTS came into the news recently when Secretary of State John Foster Dulles assured a group of Latin American delegates at a Pan American Day conference in Washington that the U.S. is willing to discuss mutual solutions to mutual problems.

Washington has quietly buzzed with talk of international commodity stabilization plans for months. Government officials report increasing industry interest in this approach to market problems through production controls.

Traditionally, Washington has flatly opposed such schemes. The new stir caused by Dulles' remarks and substantiated by Commerce Department officials is seen as premature and over-blown. All that State and Commerce spokesmen foresee is a new willingness on the part of the Administration to talk about international agreements. They doubt any such agreements—on copper, lead and zinc, for example—are anywhere near the drafting stage.

The idea is being considered more as a long-range possibility—if and when the present metal-mineral and general commodity slump begins to look too permanent.

Labor This Month

GLOOM AT MINE, MILL: Economic recession has put a heavy financial damper on the International Union of Mine, Mill and Smelter Workers. An officer of the union says it is already operating in the red ink, despite a recent increase in dues, to the tune of several hundred dollars a month.

With nonferrous mining heavily depressed and layoffs high—and the outlook for an immediate pickup still quite dim—it looks like a grim summer ahead. Union management is planning some intensive belt-tightening to force operating expenses more nearly in line with income. The goal: savings of about $7,500 a month via drastic economy. Undoubtedly, some staff layoffs are in the offing. Before long, paid members of local unions are likely to begin feeling the layoff ax, too.

This economic pinch on organized labor is not a phenomenon unique to Mine-Mill. The United Automobile Workers, for just one example, ran up a $226,244 deficit in the month of January. United Steelworkers' monthly income, reflecting dues losses because of extraordinary unemployment, is down by some $625,000 a month. It should be noted that not all unions are in such straits. The gigantic Teamsters union, whose public reputation has never been lower, thrives in the face of adversity. It claimed 1,404,739 members for the first quarter, 1958—an increase of 35,146 over the comparable span of 1957. The Teamster treasury bulges now with $41-million or so, an all-time high.

MINERS LOOK TO WASHINGTON: Mine-Mill officials are not taking a purely defensive attitude despite their economic bad times. They have scheduled a June conference in Washington, to dramatize their legislative program and buttonhole sympathetic Congressmen in behalf of aid to relieve nonferrous unemployment.

LABOR AND CONGRESS: TROUBLE AHEAD? As we have reported in this space before, the Washington outlook is still for no new major labor legislation this session of Congress. But labor scholars, looking ahead, see the organized union movement heading into stormier times.

The hard-hitting McClellan committee investigating labor rackets had filed its first report. There is only one way to appraise the report's impact: bad for labor. The stories of internal grafting and other misdeeds by union officials, albeit a relative handful of officials in a relative handful of unions, can only hurt the labor movement as a whole.

For the time being, Big Labor and Congressional critics of labor appear to be in a period of status quo—an uneasy balance in which the critics can't ram restrictive new legislation through Congress and in which, on the other hand, labor can't make any legislative gains.

Only recently, the balance seemed to be in jeopardy for a brief while. It was restored and is being maintained, in the view of most thoughtful labor students, only because the AFL-CIO moved with remarkable speed to evict the Teamsters and the bakers unions, once the seamy story of officials' mismanagement and high-handed financial legerdemain was smeared on the record.

This is labor's defense: that the Teamster and baker cases, on the face of it, show that labor can and will police its own house and keep it in order. Now, as in 1946-'47 when the Taft-Hartley Act was in the process of being pushed through Congress, labor leaders refuse to concede a single point to their critics.

Sen. McClellan, whose committee will have more reports in future months of tenor similar to those already published, is not buying Big Labor's argument that all is well. McClellan warns that labor criminality and vice pose a "real danger . . . of a racketeer, gangster-dominated economy in our country." Even allowing for exaggeration, this is a warning that is important because—if for no other reason—it signals an end to the uneasy era of good feeling that once existed between the Senator and his committee and organized labor.

What this means, many observers in Washington now feel, is a signal that the labor wheel in Congress is being greased for another turn, sooner or later, and that turn almost certainly will be against labor—to tighten rather than relax Federal influence on unions' power.

MARKETS

Subsidies for Copper, Lead, Zinc, etc.
Lead and Zinc Tariff Report Made

NONFERROUS METAL PRICES in April as measured by the E&MJ index dropped to 165% of the 1922-'24 average from 167.31% in March. The drop resulted from the 1c fall in lead, the 2c drop in aluminum and a fall of 1½c in tin.

The U.S. copper price for April rose to 24.253c from 24.018c f.o.b. refinery. The increase was due to the decreased sales this month by custom smelters (the low priced sellers) and to the slight increase in the prices at which most of their sales were made. Total sales by all sellers in the U.S. in April were under the sales made in March. Sales outside the U.S. in April were down 20%.

The foreign price was up about 0.9c. This reflects the generally higher prices paid outside the U.S. in April. The strength in Europe, indicated by higher prices on the London Metal Exchange, high premiums for electrolytic copper, and higher prices received by sellers at flat prices, is attributable to several matters. The continued strike in Chile has had some effect, though not as much as had been predicted. Some factors continue to point to the high stocks of refined copper held by producers in and outside the U.S. (end of March world total 493,587 short tons, the highest since 1939, according to the Copper Institute) and suggest this conflicts with the higher prices especially in Europe the past month. It is apparent these stocks are in "firm" hands. Custom smelters and merchants in Europe have no surplus of copper. Reductions in output by some mines, especially small mines, have reduced the custom smelter intake in Europe; they have also been getting less scrap. Some of their customers have had to get a little more of their copper from other sources. Also European merchants, who normally do more business than U.S. merchants, have had reduced amounts of copper from this source as well as less resale copper from consumers. Some of these merchants have been short. Also, some customers who buy from them rather regularly have had to try to get more copper elsewhere. And many producers are not selling spot or nearby copper. Some never sell flat price copper. This shortage among custom smelters and merchants, the continual good business by fabricators in Europe (aided by USSR wire orders), and the dissatisfaction with low prices by producers have largely accounted for the higher prices in Europe.

E&MJ gets many letters and calls from subscribers asking for past data on prices and for information on economic and market matters that have appeared in the market pages. Some regularly tear out these pages and file them or put them in a loose-leaf notebook. We are now perforating these pages so that this can be done more easily.

The 2c U.S. copper import duty the Administration wants reinstated (*E&MJ*, March 1958, p 18), the Secretary of the Interior told Congress. But on April 28 he presented to the Interior Committee of the Senate a five-year subsidy plan for copper, lead, zinc, tungsten ore and acid grade fluorspar. The copper plan would pay to U.S. miners the difference between any market price and 27½c a lb delivered. It would limit the amount to 1-million tons per year. The U.S. in 1957 mined 1,076,922 short tons; in 1956 it was 1,133,000 tons. San Manuel, and for about a year White Pine (since they are shipping to the Government under long term contract), would reduce the amount eligible to under 1-million tons. But some analysts believe output would increase with such a guaranteed income.

An international commodity agreement was proposed for consideration to the U.N. by Chile. Hearings may be held in New York, May 5-16. Doubtless it will get nowhere. Many countries will be against it, including probably the U.S., the U.K. and other important consumers. The U.S. State Dept. has been sounding out people on such agreements for months; it may feel anything is better than tariffs.

Kennecott announced it is cutting its U.S. mining again in late April or early May. It will be operated at 67% of its 1957 rate. This will be about 258,000 tons annual rate. It had cut heavily in January and also in March. This cut is from 40,000 to 50,000 tons per year .

U.S. fabricator shipments in March were a little less than in February. Shipments of refined copper to them were down considerably but shipments outside the U.S. were up.

Lead sales in the U.S. in April were slightly lower than in March but a little better than in February.

The U.S. Tariff Commission reported April 24 on the requests by the Lead-Zinc Committee for higher tariffs. It was split. Three commissioners want maximum tariffs (see *E&MJ*, October 1957, p 69 for the various rates) and three want to increase tariffs to the 1930 rates. The three that want maximum rates also want quotas equal to 50% of the average annual competitive imports 1953-57. The three dissenters analyze quota problems and hold they are unworkable and would be disastrous. They suggest much of the trouble the lead and zinc industries are now in stem from Government "doing something" for the industries in the past. Government interference, it is implied, can create more problems than it solves.

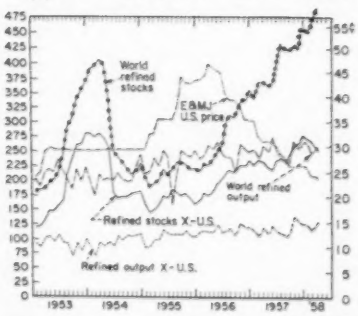
The president can take any action he wishes on tariffs or quotas. He is not obligated to do anything in connection with the Commission's proposals except report to Congress within 60 days why he acts as he does. What action he takes will be in the form of a proclamation. It will also designate the date the action is to become effective—he has complete discretion on this.

Zinc sales were lower in April than in March and about equal to February which was the lowest in recent years.

Seaton proposed a program of subsidies to the Senate Interior Committee April 28. The Government would pay the difference between the U.S. market price and 12¾c per lb. The limit per year would be 550,000 tons. In 1957 the U.S. mined about 520,000 tons. The lead subsidy would be at 14¾c and would be limited to 350,000 tons. The U.S mined 331,000 tons of lead in 1957. Such a subsidy plan would tend to 1) increase miners' incomes 2) depress U.S. and foreign prices 3) increase output in the U.S. and 4) decrease output abroad. But miners generally prefer tariffs. To some extent this may be based on the difficulty of administering subsidies. But this is not a major objection. It is only a temporary measure, some in the industry say. They want a permanent program. The subsidies would be paid by the taxpayer. He is already rebelling against heavy taxes and would regard this as a handout. Congressmen in most parts of the country would be under heavy pressure each year to cut them out. In the case of tariffs the tax is hidden and is paid by the consumer and pressure to remove them is slight. But the Administration is opposed to impediments to trade and many foreign countries are already hurt by low metal prices. (See *E&MJ Metal and Mineral Markets*, May 1, p 3 for details.)

Lower premiums on High Grade and Special High Grade zinc became general on April 9. High Grade is now 1c and S. H. G. 1.25c over the Prime Western.

Copper Production and Stocks



E&MJ U. S. price is the monthly weighted average for domestic copper, in cents per lb. Other data are from the Copper Institute and are in thousands of short tons. They include March 1958. The two series "X-U. S." are the world producer statistics less the U. S. No fabricator stocks are included.

Average Prices April *(E&MJ Quotations)*

Copper:	
Electrolytic, domestic refinery	24.253
Electrolytic, export refinery	21.631
Lead:	
Common, New York	12.000
Common, St. Louis	11.800
Silver and sterling exchange:	
Silver, New York, per oz.	88.625
Silver, London, pence per oz.	76.044
Sterling Exchange	281.706
Zinc:	
Prime, Western, East St. Louis	10.000
Prime, Western, delivered (g)	10.500
High Grade	11.094
Special High	11.385
Tin:	
New York Straits	92.957
Gold per oz. U. S. price	$35.000
Quicksilver, per flask	$231.077
Antimony, (E&MJ) (d)	32.590
Antimony, bulk, Laredo	29.000
Antimony, in cases, Laredo	29.500
Platinum, refined, per oz.	$72.000
Cadmium (a)	155.000
Cadmium (b)	155.000
Cadmium (c)	155.000
Aluminum, 99% plus ingot	26.100
Magnesium, ingot	35.250
Nickel (f)	74.000

Domestic quotations, unless otherwise stated, are in cents per pound. Sterling exchange checks, in cents. Quicksilver, per flask of 76 lb.

(a) Cadmium average based on the producers quotations.

(b) Cadmium average based on the average of the producers' and platers' quotations.

(c) Cadmium average based on platers' quotation.

(d) Domestic 5 tons or more but less than carload lots, packed in case f.o.b. New York.

(f) Contract price, f.o.b. Port Colborne U.S. duty included.

(g) Delivered where freight exceeds 0.5c.

"Free" Gold Market

Volume decreased 8%. France led in international trading volume as the price in Paris rose on political unrest. Further gold withdrawals from the U. S. continued. No Soviet sales were reported. Demands for gold in most Asiatic centers remained high. Karachi and Bombay listed world's highest prices for gold coins, $61.25 per oz. Pick's World Currency Report quotes on "free gold" per fine oz as follows:

	COINS		BARS (12.5 kg)	
	Mar. 31	April 30	Mar. 31	April 30
NEW YORK, transit	.....	.....	$35.08⅛	$35.08⅛
MANILA	$42.00	$41.75	36.20	36.00
HONG KONG	46.80	46.00	38.65	38.20
BOMBAY	59.50	61.25	58.50	59.00
TANGIER	41.25	40.60	35.20	35.21
BEIRUT	41.85	40.50	35.23	35.23
PARIS	41.50	40.75	36.30	35.75
BUENOS AIRES	37.90	38.50	35.85	36.45

Note: Prices are quoted at the free or black market value of the U. S. dollar in the local markets.

Custom Smelter Copper Price

Based on flat price and E&MJ-average price sales in U. S. for month of April reported by American Smelting & Refining Co.: electrolytic copper in standard shapes, adjusted to nearest ⅛c; ¼c deducted for selling commission.

Delivered Consumers' plant.	23.375c lb
F.o.b. refinery	22.975c lb

Major Metals

U. S. DAILY AND AVERAGE PRICES

April 1958	Electrolytic Copper (a) Domestic	(b) Export	Lead New York	Lead St. Louis	Zinc (f) Delivered	Zinc East St. Louis	Aluminum Primary Pig 99%	Straits Tin New York
1	24.425	22.050	12.000	11.800	10.500	10.000	24.000	92.625
2	24.450	22.250	12.000	11.800	10.500	10.000	24.000	92.375
3	24.375	21.850	12.000	11.800	10.500	10.000	24.000	92.750
4	24.525	22.300	12.000	11.800	10.500	10.000	24.000	92.625
5	No Market	22.300	12.000	11.800	10.500	10.000	24.000	92.625
7	24.450	22.650	12.000	11.800	10.500	10.000	24.000	92.625
8	24.400	21.725	12.000	11.800	10.500	10.000	24.000	92.500
9	24.600	21.425	12.000	11.800	10.500	10.000	24.000	93.250
10	24.375	21.125	12.000	11.800	10.500	10.000	24.000	93.000
11	24.525	21.275	12.000	11.800	10.500	10.000	24.000	92.500
12	No Market	21.275	12.000	11.800	10.500	10.000	24.000	92.500
14	24.375	21.375	12.000	11.800	10.500	10.000	24.000	92.250
15	24.300	21.275	12.000	11.800	10.500	10.000	24.000	92.375
16	24.600	21.475	12.000	11.800	10.500	10.000	24.000	92.875
17	24.025	21.475	12.000	11.800	10.500	10.000	24.000	92.750
18	23.925	21.350	12.000	11.800	10.500	10.000	24.000	93.000
19	No Market	21.350	12.000	11.800	10.500	10.000	24.000	93.000
21	23.675	21.775	12.000	11.800	10.500	10.000	24.000	93.000
22	23.750	21.800	12.000	11.800	10.500	10.000	24.000	93.000
23	23.975	21.450	12.000	11.800	10.500	10.000	24.000	93.000
24	23.875	21.125	12.000	11.800	10.500	10.000	24.000	93.125
25	24.225	21.225	12.000	11.800	10.500	10.000	24.000	93.500
26	No Market	21.225	12.000	11.800	10.500	10.000	24.000	93.500
28	24.175	21.425	12.000	11.800	10.500	10.000	24.000	94.125
29	24.275	21.925	12.000	11.800	10.500	10.000	24.000	94.250
30	24.275	21.925	12.000	11.800	10.500	10.000	24.000	93.750
AVERAGES FOR MONTH								
April	24.253	21.631	12.000	11.800	10.500	10.000	24.000	92.957
AVERAGES FOR WEEK								
April								
2	24.480	21.771	12.667	12.467	10.500	10.000	25.333	93.021
9	24.470	22.042	12.000	11.800	10.500	10.000	24.000	92.729
16	24.435	21.300	12.000	11.800	10.500	10.000	24.000	92.583
23	23.870	21.533	12.000	11.800	10.500	10.000	24.000	92.958
30	24.165	21.475	12.000	11.800	10.500	10.000	24.000	93.708
CALENDAR WEEK AVERAGES								
April								
5	24.450	22.054	12.167	11.967	10.500	10.000	24.333	92.688
12	24.470	21.579	12.000	11.800	10.500	10.000	24.000	92.729
19	24.245	21.383	12.000	11.800	10.500	10.000	24.000	92.708
26	23.900	21.433	12.000	11.800	10.500	10.000	24.000	93.188

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

April 1958	Silver (c) New York	Silver London	Sterling Exchange	Gold London	Gold (d) United States
1	88.625	75.875d.	281.5625	249s. 4d.	$35.00
2	88.625	76.000d.	281.6875	249s. 6d.	35.00
3	88.625	76.000d.	281.6250	249s. 4½d.	35.00
	Holiday	Holiday	281.7187	Holiday	35.00
5	(e)	(e)	(e)	(e)	35.00
7	88.625	Holiday	281.7500	Holiday	35.00
8	88.625	76.000d.	281.7500	249s. 3½d.	35.00
9	88.625	76.000d.	281.5937	249s. 2½d.	35.00
10	88.625	76.125d.	281.7187	249s. 3¼d.	35.00
11	88.625	76.125d.	281.7187	249s. ½d.	35.00
12	(e)	(e)	(e)	(e)	35.00
14	88.625	76.125d.	281.7578	249s. ½d.	35.00
15	88.625	76.125d.	281.8125	249s. 0d.	35.00
16	88.625	76.125d.	281.8125	249s. 1d.	35.00
17	88.625	76.125d.	281.8437	249s. 2d.	35.00
18	88.625	76.125d.	281.8437	249s. ¼d.	35.00
19	(e)	(e)	(e)	(e)	35.00
21	88.625	76.125d.	281.7500	249s. 0d.	35.00
22	88.625	76.000d.	281.6250	249s. 2½d.	35.00
23	88.625	76.000d.	281.4687	249s. 4d.	35.00
24	88.625	76.000d.	281.6875	249s. 5d.	35.00
25	88.625	76.000d.	281.6875	249s. 3d.	35.00
26	(e)	(e)	(e)	(e)	35.00
28	88.625	76.000d.	281.6875	249s. 4¼d.	35.00
29	88.625	76.000d.	281.6875	249s. 3¾d.	35.00
30	88.625	76.000d.	281.7500	249s. 2½d.	35.00
AVERAGES FOR MONTH					
April	88.625	76.044d.	281.706	—	35.00
AVERAGES FOR WEEK					
April					
2	88.625	—	281.606	—	35.00
9	88.625	—	281.687	—	35.00
16	88.625	—	281.764	—	35.00
23	88.625	—	281.706	—	35.00
30	88.625	—	281.700	—	35.00

Calendar Week Averages: New York Silver: April 5th 88.625; 12th, 88.625; 19th, 88.625; 26th, 88.625.

(e) No Market (Saturday).

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.400c per pound, the average differential for delivery charges.

(b) Our export quotations for copper reflect prices obtaining in the open market and are based on sales in the foreign market reduced to the f.o.b. refinery equivalent, Atlantic seaboard. On f.a.s. transactions we deduct 0.125c for lighterage, etc., to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingots; cathodes are sold at a discount of 0.125c to 0.15c per pound. Quotations for zinc are based on Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East, Middle West, and West effective April 9, 1958, commanded a premium of 1c per pound over the current market for Prime Western; Special High Grade 1.25c effective April 9, 1958.

(f) Prime Western delivered where freight from E. St. Louis exceeds one-half cent.

Quotations for lead are based on domestic common lead. Corroding lead commands a premium of 10 points (almost all U. S. lead is corroding grade).

(c) The daily silver quotation reported by Handy & Harman, in cents and fractions of a cent per troy ounce, is the price paid by Handy & Harman in settlement for silver contained in unrefined silver-bearing materials submitted to them for refining. It is determined on the basis of offers of bar silver .999 fine as made to Handy & Harman for nearby delivery at New York by regular suppliers in quantities sufficient to meet daily requirements, and it is usually one quarter cent below the price at which such offers are made.

The Treasury's purchase price of newly mined domestic silver is 90.5 per troy ounce 1000 fine effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

MARKETS *(Continued)*

London Metal Exchange Quotations

April	COPPER Cash Bid	COPPER Cash Asked	COPPER 3 Mo. Bid	COPPER 3 Mo. Asked	LEAD Current Month Bid	LEAD Current Month Asked	LEAD 3 Mo. Bid	LEAD 3 Mo. Asked	ZINC Current Month Bid	ZINC Current Month Asked	ZINC 3 Mo. Bid	ZINC 3 Mo. Asked	TIN Cash Bid	TIN Cash Asked	TIN 3 Mo. Bid	TIN 3 Mo. Asked
1	179¼	179½	179¾	180	73⅞	74	73⅞	74	63¼	63⅜	63	63¼	730	730½	724½	725
2	176½	176¾	176¾	177	72	72¼	72	72¼	61¾	62	61¾	62	730	730½	722½	723
3	175½	175¾	175¾	176	72¼	72½	72¼	72½	62¼	62½	62	62¼	730½	731½	728	728½
4	Holiday															
7	Holiday															
8	172½	172¾	173	173¼	71½	71¾	71½	71¾	61⅝	61¾	61⅝	61¾	730½	731½	727	727½
9	173	173½	173¾	174	71¾	72	72	72¼	62	62¼	62	62¼	732½	733½	729½	730
10	175	175¼	176	176¼	72½	72¾	72⅝	72¾	61⅞	62	62	62¼	731	733	731	732
11	172¾	173	174½	174¾	72½	72⅝	72½	72⅝	61¾	61⅞	62¼	62⅝	730	730½	728½	729
14	173	173¼	174½	175	72½	72⅝	72¼	72½	61¼	61½	62	62¼	730	730½	727½	729
15	173½	173¾	175½	176	72⅝	72½	72⅝	72½	61½	61¾	62	62¼	730	730½	727	727½
16	173	173½	175	175¼	72½	73	72½	73	62½	62¾	62½	62¾	730	731	729	731½
17	174¼	174½	176¼	176½	73	73½	73	73½	62¾	63	62½	63	730	730½	729½	730
18	176½	176¾	177½	177¾	72⅞	73	73½	73¼	62½	62⅝	62¾	62⅞	730	731	730½	731
21	177	177¼	178	178½	72	72¼	72½	72⅝	62	62½	62¼	62⅝	730½	731	730	730½
22	175	175¼	176¾	177	72½	72⅝	72⅝	72⅞	62⅛	62⅜	62⅝	62⅞	730½	731	731	731½
23	174	174½	176¼	176½	72½	72⅝	73	73⅛	62⅝	62½	62¾	62⅞	730½	731	730½	731
24	173¼	173½	175½	175¾	73	73¼	73¼	73½	62¼	62½	62⅝	62¾	730	730½	730	730½
25	175½	175¾	177¼	177½	73	73¼	73⅜	73½	62¼	62½	62½	62⅝	730½	731	732	732½
28	178	178¼	179½	179¾	74⅛	74⅜	74⅜	74½	63¼	63⅜	63½	63¾	732½	733	734	735
29	183½	184	184½	185	75½	75½	75½	75¾	63¾	64	64	64½	733	733½	736	736½
30	178	178½	179½	179¾	73½	73⅝	73⅝	73¾	62⅝	62¾	63	63½	731	732	733¼	734
Av'g's.	£175.600		£176.925		£72.869		£73.016		£62.375		£62.578		£731.013		£729.925	

Prices are for the official a.m. session in pounds sterling per ton of 2240 lb. Copper basis wire bars, lead 99.97%, zinc 98% and tin min. 99.75%.

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipments f.o.b. New York unless otherwise stated. tons of 2,000 lb. unless otherwise noted. St—short ton; lt—long ton.

MISCELLANEOUS METALS

April 30, 1958

Aluminum ingot, 99 plus % lb.			26.1¢
Antimony, spot, lb. less than carload, in cases			32.59¢
In bulk, carload lots, f.o.b. Laredo			29.00¢
Bismuth, ton lots, lb.			$2.25
Cadmium, commercial sticks, delivered, lb.			$1.55
Calcium, lb. ton lots 98%, cast			$2.05
Chromium, 97% grade, lb. contract del.			$1.29
Cobalt, 97 to 99%, per lb. eff. Feb. 1, 1957			$2.00
Germanium, per gram, 10,000 gram lots	(c)38¢ @	(d)45½¢	
Indium, troy oz.	$1.25 @	$2.25	
Lithium, lb. 98%	$9.00 @	$11.00	
Nickel, cathodes, lb (a)			74¢
Other sales, reg. sellers			74¢
Sales by dealers, etc.	70¢ @		75¢
Magnesium, 99.8% carloads, lb. producer's plants, Velasco, Texas, eff. Apr. 16			35¼¢
Palladium, troy oz.	$17.00 @	$19.00	
Platinum (wholesale lots), troy oz.	$65 @	$75	
Quicksilver, flask of 76 lb., 25 flasks or more	$230 @	$235	
Selenium, 99 plus %, lb—(Feb. 19, 1958)			$7.00
Silicon, minimum 97%, carloads, lb.			22¢
Semi-Conductor grade, lb.			$350
Tellurium, lb.			$1.65
Thallium, 100 lb. or more, lb.			$7.50
Titanium, 99.3 plus, grade A-1, max. 3% iron, lb. (b)			$2.05

(a) Eff. Dec. 6, 1956; incl. U. S. duty; (b) Effective April 1, 1958. (c) Delivered; (d) f.o.b. plant.

METALLIC ORES

Beryllium Ore, imported, 10% BeO, per short ton unit	$34.00 @	$35.00	
Chrome Ore per long ton, f.o.b. cars Atl. ports, dry:			
44% Cr_2O_3 no ratio	$24 @	$25	
48% Cr_2O_3 3 to 1 ratio	$46 @	$55	
Iron Ore, Lake Superior, Lower Lake ports, long ton:			
Old Range bessemer		$11.85(e)	
Mesabi bessemer		$11.60(e)	
Mesabi, non-bessemer		$11.45(e)	
Lead (Galena), 80%, Joplin, Mo., ton (b)		$156.12	
Manganese Ore—Per long ton unit of Mn basis 48% manganese, nearby positions, subject to premiums and penalties, c.i.f. U. S. ports, import duty extra, export duty included, $1.25 @ $1.30; both duties excluded, $1.115 @ $1.165. Long-term contract nominal.			
Molybdenum Ore, 90%, per lb. of Mo f.o.b. mines	$1.18 @	$1.23	
Columbium-Tantalum, per lb., combined oxides 10 to 1 ratio	$1.10 @	$1.15	
Tungsten Ore, per stu of WO_3:			
Foreign 60%, c.i.f. U. S. ports, duty extra	$10 @	$12.50	
U. S. scheelite, f.o.b. mill	$19.50 @	$20	
Vanadium Ore, per lb. of contained V_2O_5 f.o.b. mines		31¢	
Zinc Ore, Prime, 60% concentrate, Joplin, Mo., per ton		$56	

(a) Nominal. (b) $141.72 Apr. 1, 1958. (e) Eff. 1958 shipping season.

METALLIC COMPOUNDS

Arsenous Oxide (arsenic trioxide) lb., in bbl. carload lots delivered		5½¢
Cobalt Oxide, 72½% to 73½%, per lb. eff. Dec. 1, '56	$1.52 @	$1.55
Copper Sulphate, 100 lb eff. Jan. 13, '58		$10.70
Germanium Oxide, gram		27½¢
Molybdic trioxide, technical, per lb. of Mo	$1.38 @	$1.41
Imported, incl. 37¢ duty	$1.75 @	$2.05

ALLOYS

Ferrochrome 65 to 70%, per lb. of Cr. (4-9% C)		28¾¢
Ferromanganese, 74 to 76%, per lb., shipg. pt.		12¼¢
Ferromolybdenum, 58 to 64% Mo, lb. of Mo contained	$1.68 @	$1.74
Ferrosilicon, 50% per lb. of Si f.o.b. shipping point (3-19-57)		14.20
Ferrotungsten, 72 to 82%, lb. of W contained		$2.15
Ferrovanadium, per lb, of V delivered	$3.20 @	$3.40
Silicomanganese, max. 1½% carbon, lb., contracts		12.8¢
Spiegeleisen, per long ton, 10 @ 21% grade eff. Jan. 7		$102.50

NON-METALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (Canadian funds) ton:		
Crude No. 1	$1,470 @	$1,810
Crude No. 2	$788 @	$1,155
Spinning fibers	$353 @	$593
Shingle fibers	$190 @	$220
Paper stock	$120 @	$142
Waste	$82 @	$86
Shorts	$27 @	$75
Asbestos, f.o.b., Vancouver, B. C. (Canadian funds):		
Crude No. 1		$1,522
Spinning fibers	$494 @	$787
Shingle fibers	$142 @	$325
Asbestos, Vermont, f.o.b. Hyde Park:		
Spinning fibers	$353 @	$383
Shingle stock	$172 @	$190
Paper stock	$114 @	$145
Waste, stucco or plaster		$82
Refuse or Shorts	$39 @	$72
Barytes f.o.b. cars:		
Georgia, crude, per ton		$18
Missouri, 94% $BaSO_4$, per short ton	$16 @	$18
Crude oil well grade, min. 4.3% sp. gravity, st (a)		$18
Imported, c.i.f. Gulf Ports, st	$16 @	$18
Bauxite, long ton, f.o.b. point of shipment:		
Domestic, crude, 50 to 52% (not dried)	(c)$ 5.00 @	$5.50
Domestic, chemical, 55 to 58%	(c)$ 8.00 @	$8.50
Domestic, abrasive, 80 to 84%	(c)$18.00 @	$18.50
Imported metallurgical, per lt, f.o.b. Br. Guiana, dep. on grade		$7.14
Feldspar, bulk ton:		
Potash or soda feldspar, 200 mesh, ceramic grade	$18.50 @	$22.50
Glass feldspar, white, 20 mesh	$10 @	$12.50
Fluorspar, f.o.b. mines, bulk, 72½% effective, ton	$37 @	$41
60% effective CaF_2	$33 @	$36.50
Acid 97% concentrate, bulk, ton (eff. 12-1-56)		$50.00
Some sellers quote		$55
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00 @	$14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington		$46
Mica—Domestic, f.o.b. mines. Punch 7¢ to 12¢ per lb. according to size and quality. Sheet clear, 1½ x 2-inch, 70¢ to $1.10; 2 x 2-inch, $1.10 to $1.60; 2 x 3-inch, $1.60 @ $2.10; 3 x 3-inch, $1.80 @ $2.30; 3 x 4-inch, $2.00 @ $2.60; 3 x 5-inch, $2.60 @ $3.00; 4 x 6-inch, $2.75 @ $4.00; 6 x 8-inch, $4.00 @ $8.00. Wet ground, very fine, $140 @ $155 per ton. Bulk sales, dry ground: $32.50 @ $70.00 per ton. Scrap, $25 and up.			
Ocher, Georgia, ton, in sacks	$26.50 @	$32.00	
Pyrites, Spanish, per long ton unit of S. c.i.f. atlantic ports		Not quoted	
Sulphur, per lt, f.o.b. U. S. mines: bright		$23.50	
dark		$22.50	
Mexican, for use in Mexico, per metric ton, f.o.b. mines, 280 to 395 pesos, depending on use	$22.40 @	$31.60	
For export f.o.b. vessel, lt, dep. on grade	$22 @	$24	
Talc, f.o.b. works, ton:			
New York, purified	$18.00 @	$20.00	
Vermont, extra fine		$12.50	
Tripoli, Missouri, ton:			
40-mesh, cream colored		$50.00	

(a) Some restricted sales at $11.50. (b) Corrected. (c) Nominal.

IRON AND STEEL

Pig Iron, gross ton, basic, Valley Furnaces		$66.00
Steel, f.o.b. Pittsburgh, billets, net ton		$77.50
Structural shapes, Pa., Ala., etc, 100 lb.	$5.10 @	$5.275

Approx. 1200'

SHHH!
he's listening to a cable fault!

with the O-B Fault Locator

Because they're so hard to find, hidden cable faults often cause more lost production, more wasted man hours — more wasted cable, in fact — than the big faults that rupture insulation and actually destroy cable. That's why you'll find more and more mine properties today investing in O-B Cable Fault Locators, in many cases using as many as 10 Locators on a single property!

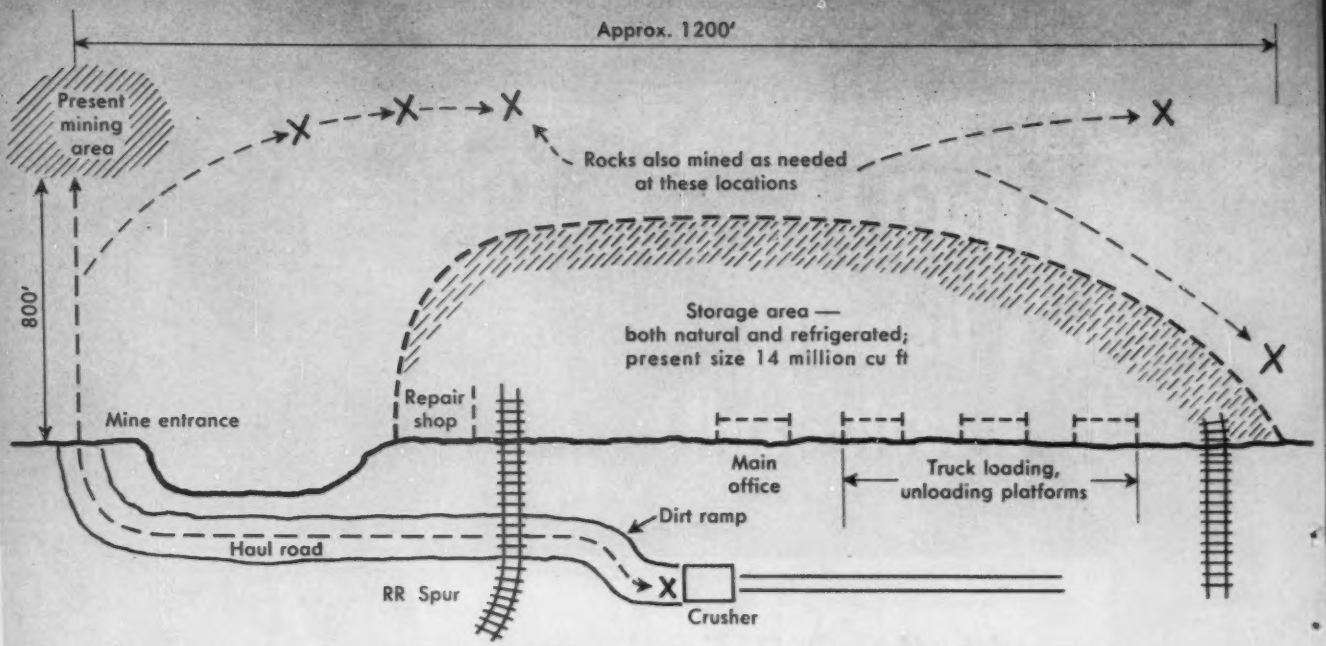
Powerful, compact (you can carry it in your pockets), rugged and virtually "tamper-proof," the O-B Locator pinpoints in a matter of minutes cable faults that would ordinarily take hours to find. The complete unit weighs only four pounds and consists of just four elements: battery and signal generator (being attached to cable end below), and headphones and slim transistor receiver. The latter, as shown above, are the only parts carried along the cable during testing! Takes only minutes to set up, tests cable up to 600 feet or longer, costs less than any cable you'll use it on! Write for complete information, or order Catalog No. 22567 to try it out for yourself.

OHIO BRASS COMPANY • MANSFIELD, OHIO

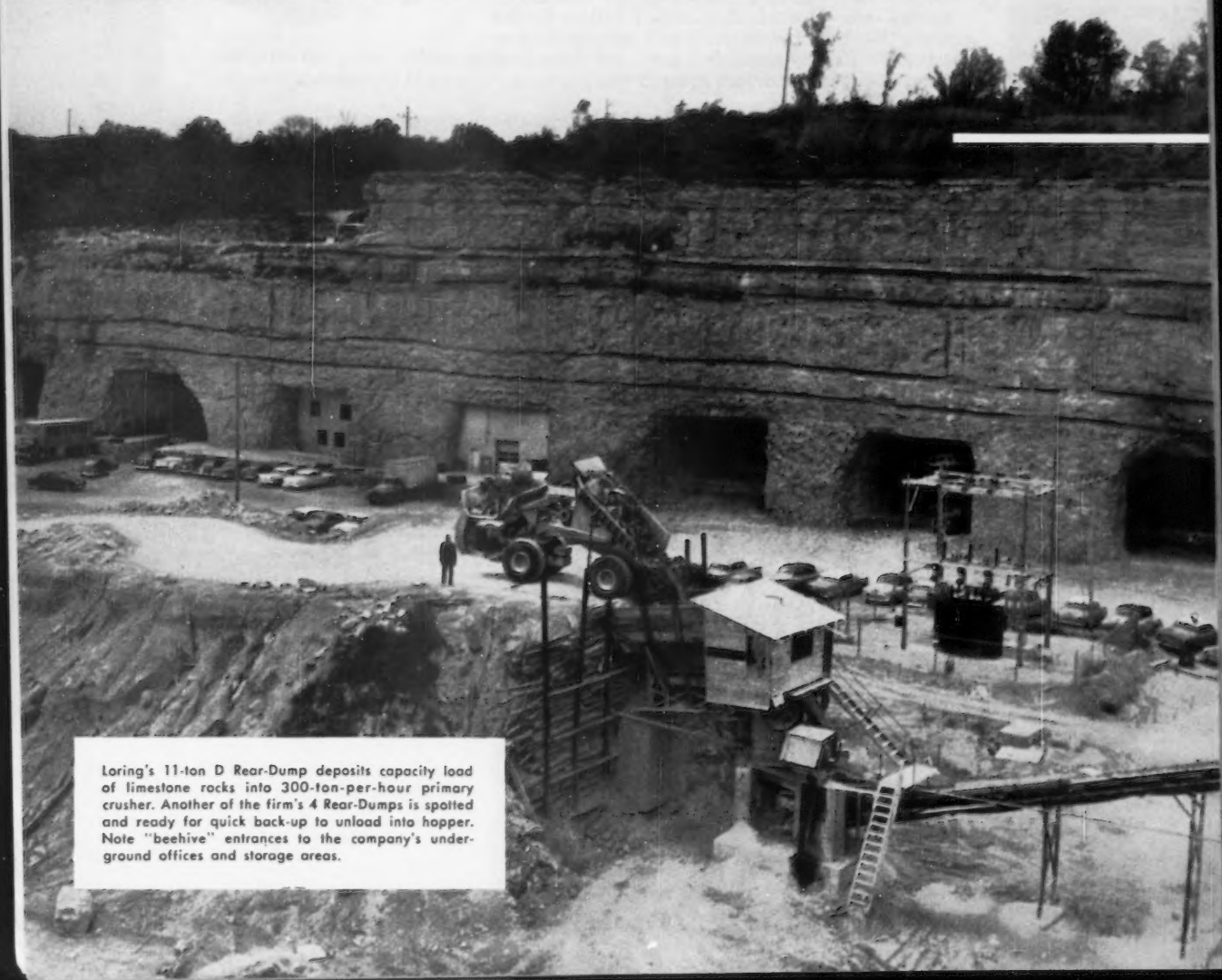
Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont.

Ohio Brass

4828-M



Sketch shows present operations of Loring Quarries' mine. Haul distance for Rear-Dumps — from shovel to crusher on top of high dirt ramp — averaged 1320'. Company is currently producing concrete aggregate, bituminous mix, road base, block plant-material, and agriculture limestone. In 1951, the firm began construction of a huge underground cold-storage plant . . . to make use of excavated space resulting from mining out the rock. Present capacity of the cold-storage plant is 14 million cu ft. It is divided into natural and refrigerated compartments. Spur tracks from the main railroad line enter the storage area for easy removal of cargo. In addition to the storage plant, numerous offices and a large, modern repair shop are also located underground — in the mined out limestone cliffs.



Loring's 11-ton D Rear-Dump deposits capacity load of limestone rocks into 300-ton-per-hour primary crusher. Another of the firm's 4 Rear-Dumps is spotted and ready for quick back-up to unload into hopper. Note "beehive" entrances to the company's underground offices and storage areas.

Two empty Rear-Dumps at right return to mine, as loaded machine at left starts haul to crusher. The short-turning 138-hp units are shovel-loaded with shot limestone about 800' inside mine. Says Mine Superintendent Clyde Edmonds, "Rear-Dumps keep us ahead of schedule, because they require less maintenance and repair. These machines do everything asked of them . . . and they're dependable."

Short turns with electric wagon-type steer proved a major advantage in positioning at shovel and hopper, and for maneuvering in all tight spots in mine. With body in travel position, D Rear-Dump makes continuous 180° turn in 24'8" — in dump position in only 18'8". Commented Operator Gary Leach, "This hauler is sure easy to operate and control . . . less tiring than other equipment. Has much better maneuverability."

How Underground Quarry solved haul problem with pivot-steer haulers

Finding the right tool for the job — to insure highest production and lowest operating costs — often is a costly, time-consuming task. Read this report on how a large producer of crushed limestone — Loring Quarries, Inc., Bonner Springs, Kansas — solved a difficult hauling problem with electric-control pivot-steer haulers. Their experience may save you time and money.

Tried two "D's", bought two more

With underground mining operations located beneath limestone cliffs near the Kansas River, Loring Quarries required a hauler that could: (a) work in tight quarters; (b) carry a good load to crushing plant fast, and; (c) be able to cut hauler maintenance and repair costs. A number of machines were tried, but none could meet all requirements.

The firm then purchased 2 LeTourneau-Westinghouse D Tournapulls® with 11-ton Rear-Dumps. Put to work on Loring's tough haul assignment, the results were outstanding. Highly pleased, the firm added 2 more Tournapull haulers within the next two years.

"Very satisfactory"

Four years after purchase of the 1st unit, Mr. E. P. Conlan, Vice President of Loring Quarries, says, "Our experience with D Rear-Dumps has been very satisfactory. We like the fact that 'D's' have no frames to twist and break, no dual tires sticking out into the loading zone to pick up sharp cutting rocks. And, with the electric-control dump, there are no hydraulic lifts to maintain. They're built simply . . . far easier and less expensive to maintain, both mechanically as well as on tires."

Ask for a demonstration

Let us show you how rugged LeTourneau-Westinghouse Tournapull Rear-Dumps can help lower *your* hauling costs. Available in 3 sizes: 11, 22, and 35-ton capacities. Call or write for complete information.

DR-1821-MQJ-2

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

DRAWPOINTS VS. CHUTES – EIMCO 630 SAVES 1/3 OF COST

Recent cost figures made available to the Mining Industry show conclusively that drawpoints have an advantage over gravity run muck through chutes.

This information is difficult to obtain in any mine, but many have been able to develop two areas in a single mine and have developed one for drawpoint, and one for chute systems.

Of the many interesting facts established during these projects, it has been amazing how much faster the drawpoint setup gets into production. It has also been difficult to believe how much savings are effected through the use of drawpoints.

In spite of dropping the muck to the floor and then picking it up again – costs have consistently been from 1/3 to 1/2 less by using the drawpoint method.

Obviously, only the best, most dependable equipment can be used in such an operation. That's why all successful drawpoint loading operators use Eimco loaders.

The 630, used in the operation pictured above, reduced costs from approximately 42¢ per ton to approximately 27¢ per ton. The savings of 15¢ pays for the equipment in a relatively short period of time.

You can save on loading costs, too. Use the only thoroughly tested and proven loading equipment. Write Eimco for information.

THE EIMCO CORPORATION

Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

New York, N. Y. Cleveland, Ohio · Chicago, Ill. Houston, Tex. · San Francisco, Calif. London, England · El Paso, Tex. Gateshead, England · Birmingham, Ala. Paris, France · Duluth, Minn. Milan, Italy · Kellogg, Ida. Johannesburg, South Africa · Pittsburgh, Pa. Seattle, Wash.

B - 321

Cut mining costs thru better clean-up

There are only two ways to increase your mining profits without a rise in the price of ore. You must increase your production, or lower your operating costs . . . or both.

Here are 9 big ways a versatile modern high-speed grader can increase mining production and cut operating costs, to boost your profits.

1. Regular, more frequent maintenance of haul roads — Smooth roads speed hauling, save tire-wear, cut maintenance, improve safety.

2. Quick clean-up after blast — Grader provides a fast, inexpensive way to move scattered fragments back against toe, thus protecting tires, machinery, and men working around the pit . . . speeding up all pit operations.

3. Clean pit floors — Regular routine in maintenance of wide traffic ways makes all areas of the pit quickly accessible. Equipment can travel to any assignment by the shortest route. Smooth access pays off, saves wear on tires and crawlers, improves drainage, prevents dirt and refuse from weathering into levels of ore below pit floor.

4. Maintain good housekeeping around plant — You need ample grader capacity to keep roads, runways, working areas around plant neat, clean and workable at all times. Level or remove the occasional spill left by heaped trucks . . . from around hoppers, grizzlies, conveyors, and trestles. A clean plant area speeds all mobile equipment operation around plant, reduces dust, and improves safety.

5. Keep stockpile toes pushed in — Weather and loading operations result in spread of toes around stockpile. This limits working space, wastes stored material. Also, working thinly-spread toes means inferior ore grades, increased loading cost. Regular grader service helps prevent this waste.

6. Keep dumps smoothly spread and level — A level, dry dump speeds hauling, cuts equipment costs. Graders can spread dumped material clear over edge. Offset blade reaches far beyond leaning front wheels, which hold against side thrust. Grader can smooth haul road on the way to and from dump.

7. Clean ore benches of washed-down dirt — Every rain washes dirt into upper benches, lowers ore grade. Prompt grader service halts "wash", provides planned drainage, piles washed-in material for easy removal by scraper or truck.

8. Assist exploration teams — A modern grader can build a well-graded roadway in a matter of hours, can speed exploration work by maintaining good haul roads.

9. Keep drainage open — In a few hours per week, a modern grader will keep ditches clean, pit dry.

Inventory capacity of your present graders

It will pay you to inventory the work capacity of your present graders. If they are more than a few years old, you will probably find a substantial saving in replacement with the faster, more powerful, big-capacity graders currently on the market. We will be glad to assist by furnishing specifications and comparative statistics on our L-W line of modern Adams* graders, manufactured by the LeTourneau-Westinghouse Company.

Reprints available on request.

Moving fast, this L-W model 660 Adams grader keeps pit floor clean, saving wear on fleets' tires and treads. Permits driving equipment by shortest routes, improves drainage.

This high-speed modern grader keeps haul roads in good condition to speed movement of haulers, reduce wear on tires and machines.

Occasional spill over sides of heaped trucks . . . around hoppers, grizzlies, conveyors, and trestles . . . can litter concentrating plant area, slow traffic, damage tires. Regular grader service speeds operations, saves on maintenance and repairs. *Trademark G-1812-M-1

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

We are now equipped to ship Molten Sulphur in tank car lots to any point in the United States or Canada.

Advantages? No contamination . . . no wind or water losses . . . cheap unloading . . . cheap melting cost . . . ready to use.

We shall be glad to discuss this new shipping service in connection with your requirements.

Texas Gulf Sulphur Co.

75 East 45th Street, New York 17, N. Y.
811 Rusk Avenue, Houston 2, Texas

Sulphur Producing Units — Newgulf, Texas; Moss Bluff, Texas; Spindletop, Texas; Worland, Wyoming

A sure way to "lower the boom" on your stripping costs

Building new haul road at Kentucky pit, modern B Tournapulls with 27-yd Fullpak scrapers heap big loads of sticky clay fast. Machines' excellent maneuverability in the cut and on the fill, plus high travel speed permited faster cycles . . . helped lower production costs.

When stripping overburden, building haul roads, or leveling sites for camps or drill set-ups — fast, high-production earthmovers can play an important part in keeping your costs down. That's why so many pit owners rely on LeTourneau-Westinghouse Tournapull® scrapers. These versatile machines heap big loads quickly, haul anywhere, and spread fast. Here are 4 big reasons why:

1. Most power used for cutting

When loading, Fullpak® scraper wheels ride inside cutting width . . . hold flat-bottom bowl low (1° flow angle on 27-yd B Fullpak). Dirt slides in easily, almost horizontally. With bulk of power used for cutting — little for bulldozing against high-angled blade — scraper heaps big loads fast. With blade location and bowl shape designed for easy, fast-flow loading, Fullpaks pack in the last yard almost as easily as the first.

2. Easy loading in tough conditions

High apron-lift permits fast loading and unloading of chunky materials. Quick-release clutch on hoist-motor lets your operator rapidly "pump" bowl up and down . . . helps get big loads in loose dead-flowing material. Streamlined bowl construction makes it easy to load next to vertical banks and around obstructions.

3. Poor footing no barrier

When working Tournapull scrapers, there's little need for weather shutdown, nor to extend your haul distance to bypass mud, sand, and soft going. Prime-mover has an exclusive power-transfer differential that automatically slows spinning wheel and transfers up to 4 times the power to wheel on firmest footing. The L-W differential works *continuously* — on turns, through mud and slippery footing, over rough, uneven ground. This gives you better traction throughout any haul cycle . . . for faster, easier, low-cost stripping, roadbuilding, or other dirtmoving.

4. Unloads all material fast

Scraper's positive-ejection tailgate moves straight forward with full power on the thrust. There's no need to lift the load. Tailgate has plenty of power to force out sticky clay, mud, rocks — wipes bowl clean in a single pass. Inside of bowl is cleanly designed, with no angular obstructions to block material flow. Return of tailgate is by electric power — there are no troublesome springs.

Try one at your pit

Put a modern LeTourneau-Westinghouse Tournapull scraper to work in your pit. Use it on any dirtmoving job you wish — stripping overburden, cutting drainage ditches or sluiceways, stockpiling, refilling, landscaping, etc. Check production, check costs! You'll find these units complete cycles faster . . . give you higher production at low cost. 3 scraper sizes with capacities of 9, 18, and 27 yd — diesel-powered 2-wheel prime-movers with 138, 210, 300-or-335 hp. Call for full details.

Convert dirtmover to rugged rock-hauler

For less than ¼ of the cost of the Tournapull with scraper, you can add a Rear-Dump trail-unit to interchange with original scraper behind same prime-mover. In dump position, as shown, 35-ton B Rear-Dump makes continuous 180° turn in just 27 ft — in travel position, 35 ft. Rear-Dump's all-steel body with tri-layer bottom withstands the pounding of heavy rock. Unit dumps smooth and clean over the edge of the bank . . . hauls anywhere. Other trail-units to increase prime-mover's usefulness also available.

P-1835-MQ-1

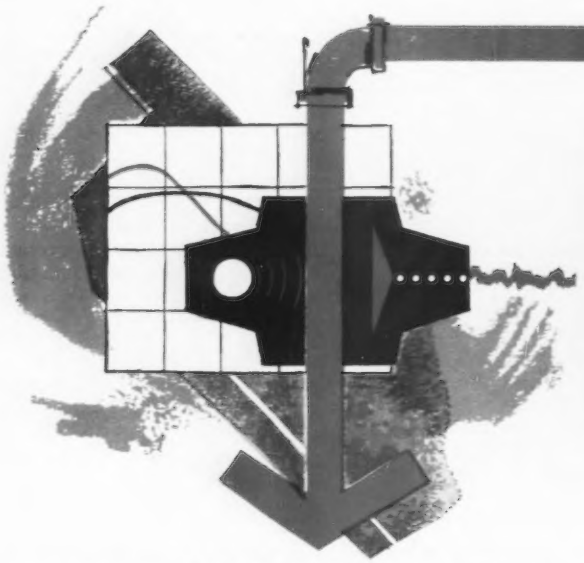
LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

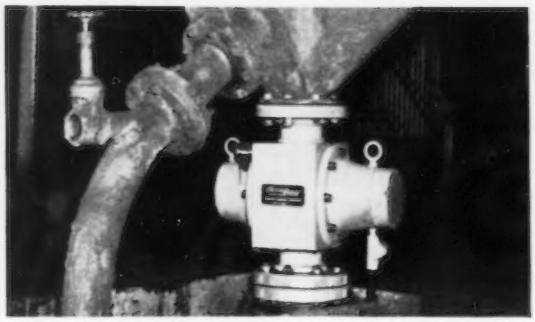
A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

cut production costs with AccuRay® density measuring systems

The relative solids and liquid content of slurries may be accurately evaluated and controlled with AccuRay Density Measurement Systems. This means that the maximum amount of solids may be transported at lower pumping costs. Holding liquid content to minimum requirements reduces fuel costs for drying. Time-consuming sampling procedures are eliminated. AccuRay Density Measurement Systems, designed for rugged industrial service, maintain and control accuracies to close tolerances.





AccuRay Specific Gravity Measurement units on heavy media vessels at Clinchfield Coal Company, Moss No. 2 Plant, insure the customer a cleaner and more "true" product. This AccuRay installation results in a high-quality product, more efficient operation, and lower production costs.

More than 60% of the nation's tin cans are made from steel controlled with AccuRay Systems

67% of the tires manufactured in the United States are built of fabric controlled with AccuRay Systems

8 of the 10 largest paper manufacturers use AccuRay Measurement Control Systems to maintain uniform basis weight

Please send Bulletin NI-158 for complete details on AccuRay Continuous Flow Density Systems

Name ..... Title .....

Company .....

Street .....

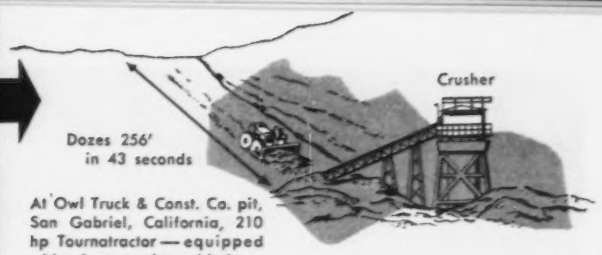
City ..... Zone ..... State .....

Application .....

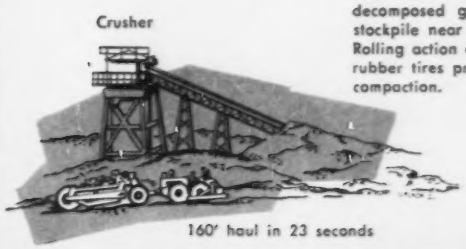
Industrial Nucleonics CORPORATION

1151 Chesapeake Ave. • Columbus 12, Ohio

The WORLD'S LARGEST Manufacturer of Nucleonic Industrial Process Control Systems



At Owl Truck & Const. Co. pit, San Gabriel, California, 210 hp Tournatractor — equipped with wings on dozer blade — pushes heaped load to crusher at speeds to 7.5 mph.



Tournatractor scraper spreads decomposed granite rock on stockpile near crushing plant. Rolling action of tractor's big, rubber tires provide excellent compaction.

How Owl Truck & Construction Co.

produces 7,000 tons of granite road-base daily

Owl Truck & Construction Co., Alameda, California, produces 7,000 tons of crushed, decomposed granite rock daily, at their San Gabriel, Calif. pit. Material is used for road-base under concrete or asphalt.

To achieve required production, the company tried two crawler-tractors for short-haul dozing of material to crushers. This method was found to be slow and expensive. Due to loose abrasive rock, crawler's tracks had to be replaced every 1000 hours. Owl Truck then purchased 2 modern LeTourneau-Westinghouse rubber-tired Tournatractors® to handle this phase of the job.

Here's how these rubber-tired tractors helped speed production:

512' dozing cycle in 1 min. 46 sec.

First, the decomposed granite rock is loosened. Then Tournatractors — traveling in 3rd gear (7.5 mph) — doze heaped load 256' down 12-15% grade to crusher in 43 seconds. Tractors then back up same distance in high gear (7.2 mph) in 1 minute 3 seconds . . . completing 512' cycle in 1 min. 46 sec. Fast dozing cycles like this helped boost production.

Tows scraper on long hauls

To move material long distances, one of the tractors occasionally tows an old L-W Carryall Scraper. With speedy Tournatractor used as prime-mover, scraper self-loads 8 yds. in 37 seconds over 125'. Unit then hauls 160' down 8% grade in 23 seconds . . . and spreads material on stockpile in 13 sec. (Stockpiled material is dozed to crusher by rubber-tired tractor when needed.) Tractor-scraper returns 334' to load area in 48 sec. . . . completes a 695' cycle every 2 min. 1 sec. The one-man Tournatractor-scraper combination averaged 24 loads or 192 yds. per hour.

"Low maintenance costs, increased production"

Pleased with Tournatractor's performance, Pit Superintendent Walter C. Butler said, "This tractor definitely has a place in pits and quarries. The low maintenance costs and increased production show up well on the balance sheet." The operators were also enthusiastic about these rubber-tired tractors. Emery F. Dolson, Jr. says, "There's a lot less wear and tear on me when operating Tournatractor instead of a crawler."

Compare Tournatractor with present dozers

Why not ask for a demonstration? Compare this high-speed, go-anywhere rubber-tired tractor with your present dozers. See how *you*, too, can increase pit production and cut operating costs. Call or write for full details. CT-1562-QJ-1

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

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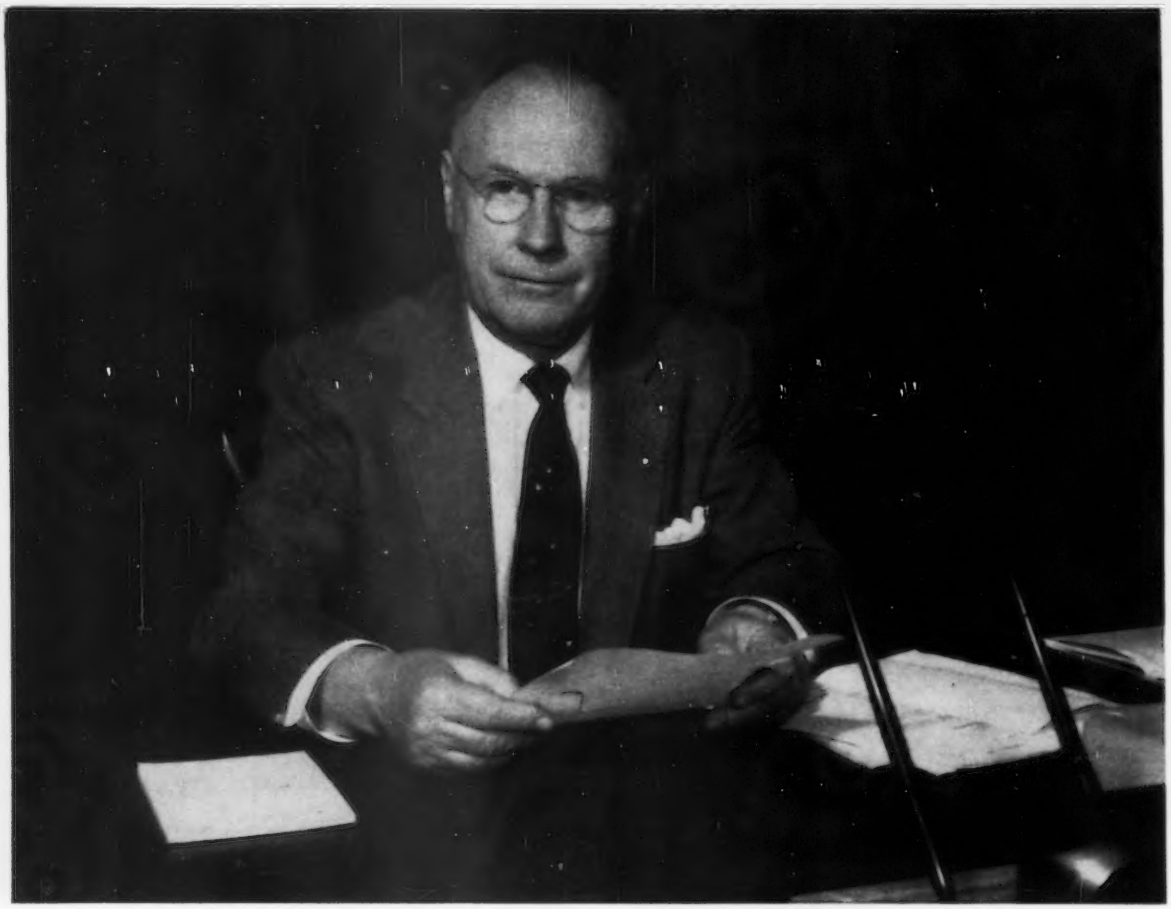
Where quality is a habit



WHY ARMAND LABBE CAME TO ALBANY...

Recently, Armand L. Labbe joined the staff of the Industrial Fabric Division of Albany Felt Company as industrial consultant on problems concerning smoke and dust control and other phases of dry filtration. The reason: *to help you find solutions to difficulties in these important areas!*

Considered one of the nation's foremost authorities on smoke and dust control in mining and quarrying, smelting, metal-working, chemical and allied industries, Mr. Labbe recently retired from his position of metallurgist with the American Smelting and Refining Company, after 45 years of service with that firm. In his new capacity, his wealth of experience and background will be available to help you solve dust, smoke and other filtration problems, as time permits.

Albany Felt Company is one of the world's largest manufacturers of special industrial fabrics for wet and dry filtration, finishing and specialized conveying. Please write today for further information on the many custom fabrics and products which are available to meet your requirements more efficiently and economically!

ALBANY
FELT COMPANY
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INDUSTRIAL
FABRIC
DIVISION

THE WORLD'S FOREMOST PRODUCER OF CUSTOM FABRICS FOR INDUSTRY

No. 5 in a series

Right off the Wire

An automatic ultrasonic welder makes tack welds without heat at the rate of 200 inches per minute.

Miniature mercury lamps are being used in batteries of twelve for night aerial photography. An area of sixteen square miles can be lighted from an altitude of 20,000 feet.

A new electron microscope permits the examination of opaque specimens.

An electronic converter makes any radio an appliance timer.

A three-year test of a 43,000-pound ship's propeller made of nialite (nickel-cadmium bronze) shows no wear caused by erosion or cavitation.

D. W. Kitchin and O. S. Pratt of Simplex recently made two major discoveries in studying corona spaces in cables — one, by observing internal pressure decrease, and another by mapping with silver cyanide solution.

A distillation column sixteen feet high and made entirely of glass is said to be the world's largest. It will be used to make silicon carbide with impurities of only one part in ten billion.

It has been demonstrated for the first time that petroleum is a colloidal dispersion. This knowledge may help in obtaining greater recovery from existing oil reserves.

A giant machine to hold large assemblies for welding can lift, tilt and rotate weights up to forty tons.

A tiny photoflash bulb is said to give the same amount of light as one four times its size. It uses zirconium rolled to foil gauge.

Over 1300 industrial concerns in this country are now using radioactive byproducts. About 200 were added to this list during the last year.

Air power for generators in remote installations, such as aids to air or marine navigation, can be supplied by a modern windmill which has a thirty-foot, three-bladed "propeller." It maintains constant speed.

Temperatures as high as 3500°F. are resisted by a new molded plastic.

Polyethylene is now made with an ultraviolet inhibitor and is said to last four times longer than the unprotected form.

Further information on these news items and on Simplex cable is available from any Simplex office. Please be specific in your requests.

Nuclear reactors may be used as economical sources of heat to convert coal into gaseous or liquid fuels.

A stereo cartridge to play the 45-45 Westrex groove records is in production.

South Carolina is putting its automobile drivers' licenses on photosensitive, anodized aluminum. They will be used for four years.

Speeds of 15,000 miles per hour and temperatures as high as 18,000°F. can be reached momentarily in a new wind tunnel being built to test missile nose cones.

"Silicone Insulation as Applied to Wire and Cable" is the title of a research paper by P. H. Ware of Simplex. This insulation is trade named "Thermoplex".

Flexible tanks of rubberized fabric are being made for use in the oil fields. They hold 15,000 gallons, but can be rolled into a package eight feet by two and one half feet when empty.

Kraft paper, shrunk after forming, is being used for shopping bags and multi-walled sacks. It stretches under tension and is said to be twenty per cent stronger than papers now in use for this purpose.

A portable scale that needs no pit is made for roadside weighing. It can handle vehicles sixty feet long weighing seventy tons.

Protection plus

C-L-X (sealex) is a continuous, lightweight, exterior metallic cable sheath recently introduced by Simplex. Impervious to gases, chemicals and water, C-L-X is ideal for almost any installation including aerial applications, industrial distribution and direct burial, as shown above. Practically any type of cable core can be used for such applications as power, control, signal and communication installations.

Other features include extreme pliability, ease of handling, long life, easy installation and relocation, and color coding for voltage or circuit identification.

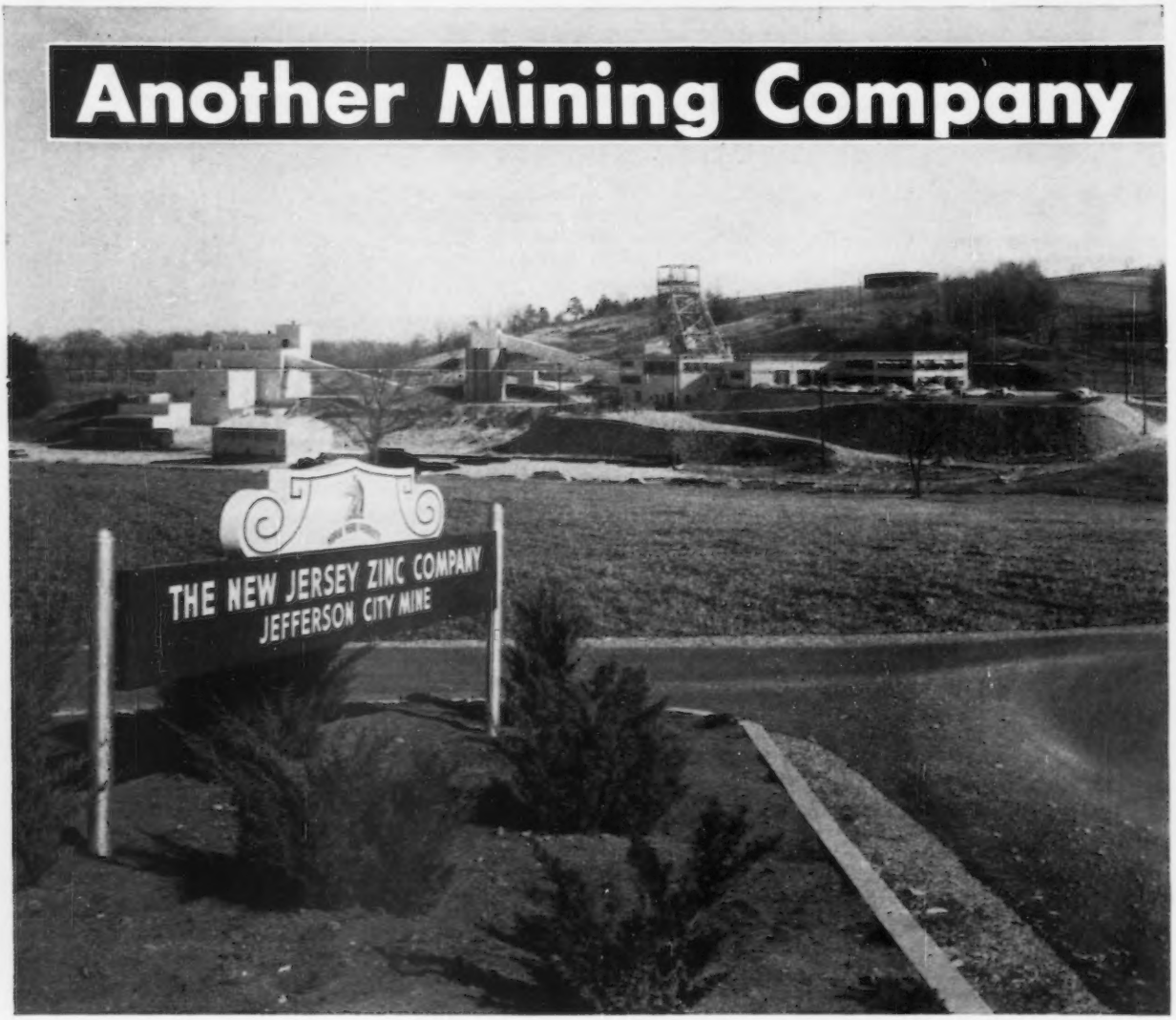
SIMPLEX WIRE & CABLE CO.
Cambridge, Massachusetts and
Newington, New Hampshire

Simplex

Highest quality cables for: Mining · Power & Lighting · Construction · Transportation · Communications · Signalling

"The American manufacturers of transoceanic telephone cables"

Another Mining Company



This is a new important mining operation that is taking advantage of the cost saving benefits made possible by the Gismo Self-Loading Transport. The Jefferson City Mine of The New Jersey Zinc Company is an example of the result that can be obtained by careful planning, design and selection of equipment.

This Gismo machine makes it possible for you to devise and organize a simple mining method. We believe the lowest cost possible is obtained when your plan provides for the fewest pieces of equipment, supplies and men. The Gismo is simple, versatile — mucks in development or production, can drill as a jumbo, make its own roadways, etc. It can transfer its load direct to cars by means of ramp cars . . . or direct to cars or trucks by means of ramping-over (see circled photo at right) . . . or direct to surge pocket for transfer to a common haulage system or method.

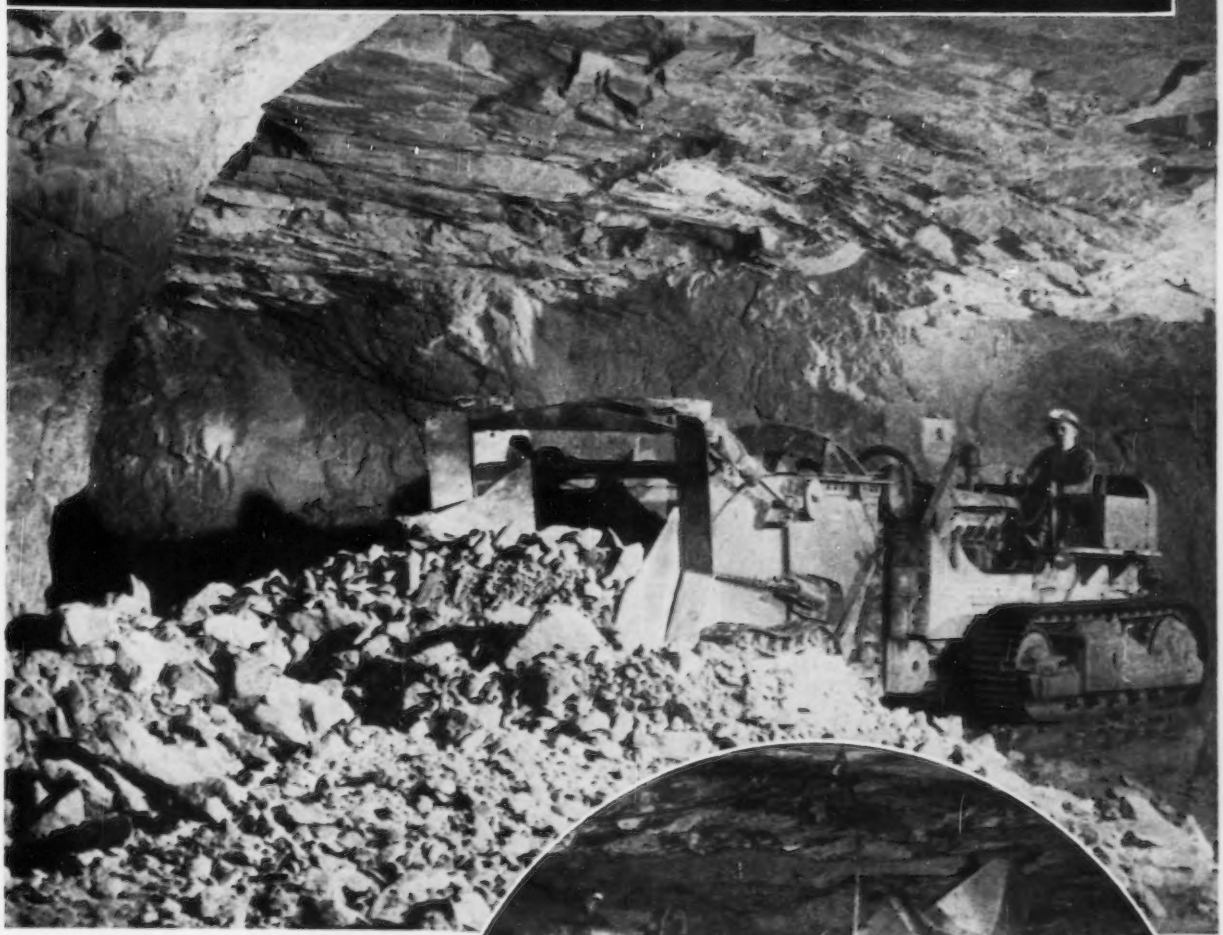
Investigate the extraordinary economies that have been obtained with the use of this remarkable machine. Its principle provides you with a new fundamental opportunity to devise ways and means of cutting costs that you have not had for many years. Write us today. Sanford-Day Iron Works, Inc., Knoxville, Tenn.

SANFORD-DAY

KNOXVILLE, TENNESSEE

SUPER MARKET FOR MINE CARS — all types . . . PRECISION WHEELS . . . BROWNIE HOISTS . . . GISMO SELF-LOADING TRANSPORT that loads in development or production . . . transports . . . supports 2 to 5 jib mounted drills . . . back fills . . . moves boulder rocks . . . makes its own roadways and cleans up completely — a new method of hard rock mining offering a tremendous reduction in cost per ton!

Puts the Gismo® to Work!



THE NEW JERSEY ZINC COMPANY'S Jefferson City Mine incorporates the latest and most modern equipment, including the Gismo, S-D Ore Cars and S-D "Brownie" Hoist. Above you see the Gismo mucking out a load. Circled photo at right shows the ramp-over-cars' transfer point. One man, the Gismo operator, handles the entire operation by means of push-button control of the S-D "Brownie" Hoist. Operator's control lever is located just below roof above the ramp. The S-D "Brownie" Hoist automatically moves trip when another empty car is positioned under ramp. Operating arm located beside cars "tells" hoist when to stop the trip. The S-D Ore Cars haul production to ore pass.

Koehring® Dumptor® shuttles underground *without turning*

Shuttling back and forth in this hillside mine, Koehring Dumptor, heavy-duty 6-yard hauler, drives into tunnel, gets its load — then drives out at the same speed as it entered. There's no room inside to turn — *and no need to turn,* because Dumptor operates with equal ease and speed in either direction. It gets this unique, no-turn operating advantage through a Koehring constant-mesh transmission that gives the same 3-speed travel forward and reverse. Dumptor no-turn hauling has gained wide acceptance in both underground and strip mining, as shown on these pages. It solves problems of operating along overhead trestles, on open-pit ledges, narrow haul roads — is especially practical for stockpiling. There's an important production advantage, too. Every turn eliminated cuts 15 seconds off cycle time. This adds up to a substantial increase in yards or tons hauled per hour. For example — by saving only 2 turns on a round trip, time studies prove that Dumptor often increases hourly yardage output more than 10% on an average 1000-foot haul. Better have your Koehring distributor show you what Dumptor no-turn hauling can mean on your mine, quarry or stockpile operations. Call him today or write for new 24-pg. catalog.

Mining in Mexico — Rugged, mountainous area near Mexico, D. F., is dotted with deposits of valuable red and blue sand. Mine haul roads are steep and winding. At a typical mine (above), 3 Koehring Dumptors haul 600 feet from pit to hopper. Their big, safe brakes, power steering, 24% grade-climbing ability really pay off on work like this!

1¼ miles underground — Hauling conditions are as tough as they come in this Canadian lead zinc mine. It's located 6000 feet up a mountainside. Ore is heavy — and the haul is 1¼ miles underground. Conventional dump trucks tried it — proved unsatisfactory — were replaced by a fleet of 8 Koehring Dumptors, now working 2 shifts a day.

Dump time: 1 second — At quarry crusher, Dumptor drives up, body forward. Operator trips a body-release lever, and *gravity* tilts the body — dumps the load instantly. Free-swinging kick-out pan breaks load suction for fast, clean dump when hauling wet, sticky materials — bolts down to floor of body when handling heavy broken rock like this.

Re-working a slag bank — Slag is being reclaimed from this waste bank, swept by a magnet to remove scrap metal, run through a crusher, and used as sub-base material on roads. A Koehring 1½-yd. 605 shovel (above) loads slag into Dumptors, a heavy-duty, big-production team! Check Koehring line of shovels (½ to 3 yds.) cranes (10 to 95 tons).

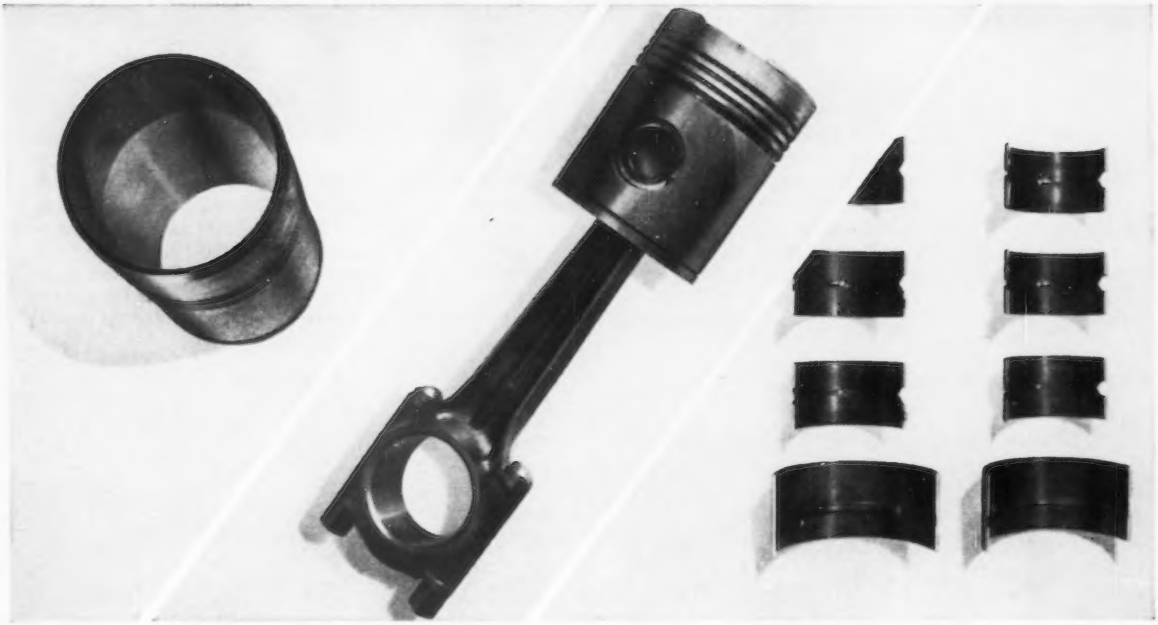
KOEHRING DIVISION OF KOEHRING COMPANY, Milwaukee 16, Wis.

K819

The Engineer's Field Report

CASE HISTORY
RPM Delo Oils
LUBRICANT
Progressive Transportation Co., Compton, California
FIRM

RPM DELO holds piston wear to .001" after 201,253 miles of on-and-off highway hauling



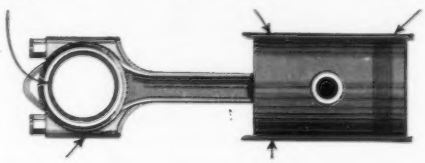
LUBRICATED WITH RPM DELO Oil, these engine parts were pulled from a Cummins HR diesel after 201,253 miles. A portion of this mileage was put on during four months of rugged service spotting loads of heavy pipe in the Arizona desert. When the engine was taken down, after two years of this on- and off-highway hauling, Progressive Transportation Co. found RPM DELO Oil had kept lacquer, gum, sludge, and deposits from forming...rod bearing wear varied between .0005 and .001 inch and pistons showed maximum wear of only .001". No wear at all evident on main bearings. Progressive Transportation uses RPM DELO Oils in all its large fleet of tractors—some of which have traveled well over 200,000 miles without overhaul.

Why RPM DELO Oils prolong engine life

Special compounds stop corrosion

Anti-oxidant resists lacquer formation

Detergent keeps all parts clean



Metal-adhesion qualities keep oil on parts in running or idle engines—inhibitor resists foaming

LUBRICATING OILS RPM DELO

For More Information... about this or other petroleum products of any kind, or the name of your nearest distributor, write or call any of the companies below.

STANDARD OIL COMPANY OF CALIFORNIA, 225 Bush Street • San Francisco 20, California

THE CALIFORNIA COMPANY, P. O. Box 780 • Denver 1, Colorado

STANDARD OIL COMPANY OF TEXAS P. O. Box 862 • El Paso, Texas

E&MJ NEW PRODUCTS DIGEST

In this issue—an excavating wheel, a dustless stoper, a zipper conveyor, plus one and a half pages on new products and new literature on pipe, tubing and hose, valves and accessories. One reader reply card is for the regular new products coverage; the other is for the special section on pipe and fittings.

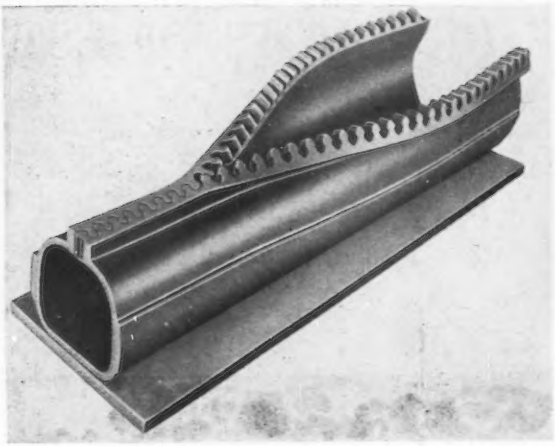
General Electric Co. Opens Eleven Drive-In Locomotive Repair Shops

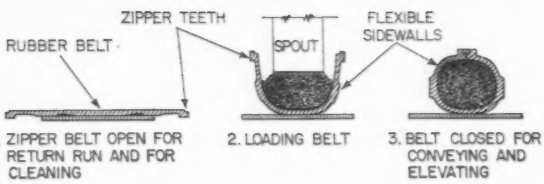
INDUSTRIAL LOCOMOTIVES weighing up to 120 tons can now be overhauled, much like the family car, at eleven General Electric Co. service stations located throughout the U.S. GE's Howard F. McCullough, manager of the Service Shops Department, said that complete overhauls and rebuilding jobs can be done at North Bergen, N.J., Pittsburgh, Cleveland, Dallas, San Francisco, Atlanta, Salt Lake City, Boston, Chicago, Minneapolis, and Portland, Ore.

Mr. McCullough estimated that there are more than 15,000 industrial locomotives currently in use in the U.S., mostly centered around the location of GE's new shops. General Electric will be able to do a complete, guaranteed overhaul in from four to six weeks, at a cost of from 20 to 40% that of a new locomotive of like size and horsepower.

Decentralizing and expansion of locomotive repair and overhaul service means real maintenance savings to many locomotive owners in both freight rates and lost-time due to the repair work. Because of the capital cost involved in buying a locomotive—a medium size machine might cost upwards of $75,000—few users are likely to own a spare. If a plant owner needs but one locomotive, Mr. McCullough added, the chances are he will buy only one. It is most important that it be maintained in workable and efficient operation. Sudden failure could present the miner with a real operating loss.

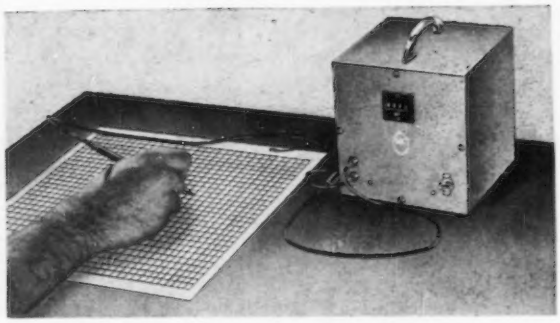
For more information on new products and for copies of the literature (on pp 43 and 44, and both sides of the reply card) circle the proper number on the proper New Products reply card, give your name and address, and mail card to E&MJ.





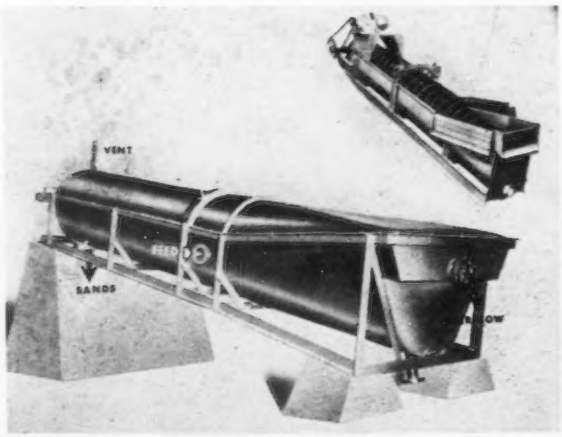
Zipper Conveyor Remains Dust-Tight (1)

According to A. D. Sinden, vice-president, Stephens-Adamson, the Zipper Conveyor is the only conveyor on the market that conveys and elevates by continuously wrapping material in a package, moving the package and its contents to a new location and gently unwrapping it. New design is of one-piece construction.



Electric Calculator Measures Map Area (2)

An electrical instrument used for determining the number of square inches, acres, miles, etc. in a given area on a map, aerial photograph or drawing has been developed by Martin-Kuykendall Co. Area Calculator is highly accurate (99%), rapid and comes with tables to convert inches to any measurement.



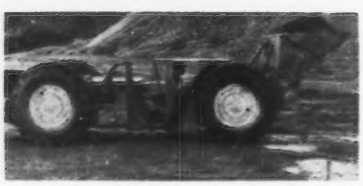
Vapor-Tight Spiral Classifier (3)

Denver Equipment Co. has introduced the Denver Vapor-Tight Spiral Classifier in all sizes from 6-in. laboratory to 60-in. dia production models. Classifier is ideally suited for sizing and washing at elevated temperatures because the lower bearing is located above the pulp level.

Digging Wheel Has Special Roller Conveyor (4)

Roller conveyor designed by United Electric Coal Companies has been in operation on a Kolbe Excavating Wheel at the Buckheart mine, Canton, Ill. Kolbe Wheel was developed some 15 years ago to remove overburden in a continuous operation. Roller conveyor now makes it possible to handle a larger tonnage with the machine.

Earthmoving Equipment



Wagner Tractor, Inc. nicknamed their 4-wheel mucker the "Mole." All parts of the unit, including the 1¼-yd bucket, are lower than the top of the tires. Mole has 4-wheel drive and steer. First Mole is at Hidden Splendor. **(6)**

Rear dumper with 27-ton payload rating has been announced by Euclid Div., General Motors Corp. Model R-27 is equipped with 300hp Detroit Diesel or 335hp Cummins engine. Top loaded speed is 34 mph. Dumping angle is 61 deg. **(7)**

All electric deck crane engineered by R. G. LeTourneau, Inc., for 25-ton capacity is described in 4-page bulletin. It is recommended for use aboard marine craft, docks and other locations where constant lifting is required. **(8)**

Heavy-duty backhoe and loader line of International Harvester Co. has added two International Pippin and International Wagner models—325 front-end loader and 350 backhoe. Six models of the Wagner loaders range from 12.8- to 68hp. Two models of Wagner backhoe are supplied for the larger Wagner loaders. Pippin loaders and backhoes come in three sizes each for International 330 and 350 Utility tractors. **(9)**

Model 404 diesel-powered 4-cubic yd capacity tractor shovel is described in Yale & Towne bulletin. Trojan line is designed for 4-wheel drive, heavy duty bulk handling. **(10)**

Manitowoc Engineering Corp. has added a 3-yd Model 3600 convertible shovel to their line. Unit converts to clamshell, crane or dragline easily. **(11)**

U-shaped dozer blades are available from Balderson Inc. for Caterpillar D7 tractors. BD7U blade angles the two side sections at 25 degrees. **(12)**

Ford Motor Co. has entered the diesel powered utility tractor field with a 35hp engine available in Ford's four models of utility tractors. **(13)**

Newest improvements in OC-4 crawler tractors are discussed in Oliver Corp. literature on this 28hp unit. **(14)**

Oliver Corp.'s new 1¾-yd front-end loader is 100% power equipped. OL-175 has power steering, shift and 4-wheel hydraulic brakes. Unit is powered by 109hp gasoline or 133hp diesel powered. **(16)**

Construction Equipment Div., Baldwin-Lima-Hamilton Corp. has announced a 70-ton capacity four axle truck crane, Type 84-T available on 8x4 and 8x6 carrier drives. Can be gasoline or diesel powered. **(16)**

Torque converter model of the Adams 550 motor grader is the latest addition to the LeTourneau-Westinghouse equipment line. Designated Power-Flow 550, model embodies same basic design as standard 550 units. **(17)**

Yale & Towne Mfg. Co. has a 2500-lb capacity Model Y-18 industrial tractor shovel available. Dumping clearance is 6 ft. Top speed is 13 mph. Bucket tilts back 45 degrees at ground level for easy loading and carrying. **(18)**

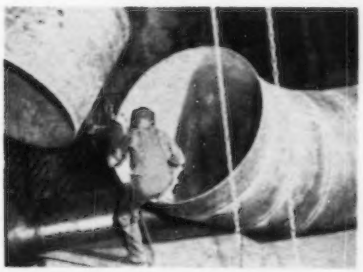
Caterpillar Tractor Co., has introduced two new series of DW20 and DW21 wheel tractors equipped with Super-Turbo engines having maximum of 320hp. Increased lugging ability and higher road speeds are advantages. **(19)**

Job tested for job economy is the title of an 8-page bulletin prepared by Caterpillar Tractor Co. with job stories on Cat D7, D8 and D9 units. **(20)**

Kaiser Steel Corp. reports that three 22-wheel ore-gondola off-highway trucks are being shipped to Marcona mine in Peru. Capacity is 80 tons. Gondolas, with 12-ft sides, were manufactured by Western Iron & Body Works Inc. **(21)**

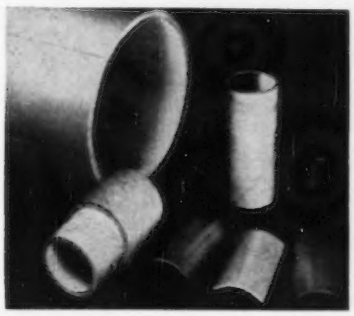
All aluminum frameless dump trailers are being built by Anthony Co. with up to 18-cubic yd capacity. Large unit is 1½ tons lighter than steel counterpart would be. Payload is 25 tons. Teleramic hydraulic hoist is used. **(23)**

Pipe, Tubing, Valves and Fittings For Mine, Mill and Refinery



Wrought iron O. D. pipe installations are illustrated in A.M. Byers Co. literature. 8pp. **(51)**

Pipe and tubes for elevated temperature service, including much technical data, are illustrated in National Tube Div., U.S. Steel Corp. bulletin. 60pp. **(52)**



Polyvinyl chloride pipe from National Tube Div., U.S. Steel Corp., is presented in 36-page bulletin (No. 24). **(54)**

Flexible rubber pipe, reducers and expansion joints in the General Rubber Corp. line are illustrated in catalog No. 575. 6pp. **(55)**

Stainless steel pipe and tube are available from Union Steel Corp., according to 8-page bulletin on Unionweld design. **(56)**

Chemical porcelain pipe, fittings and valves in the U.S. Stoneware Co. line are presented in an 8-page bulletin (CP-50). **(57)**

Corrosion-resistant pipe made of integrally bonded clad steel in diameters as small as 4 in. is available from Lukens Steel Co. **(58)**

Natural polyethylene tubing is available in standard 100-ft coils measuring 1 in. O.D. by 0.814 in. I.D., according to literature from American Agile Corp. **(59)**

Ames Positive-Lock industrial pressure pipe in 2-, 3-, and 4-in. stock diameters and stock lengths of 20, 30 and 40 ft can transmit liquids or semi-solids at up to 1500 psi, according to W.R. Ames Co. literature. **(60)**

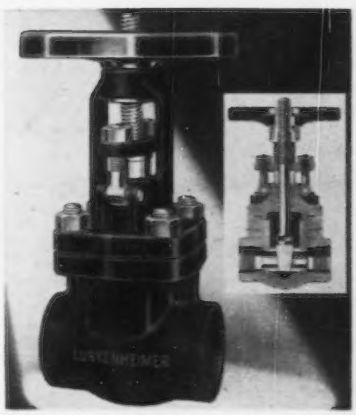
Stainless pipe and tubes bulletin (No. 3) from National Tube Div., U.S. Steel Corp. is 28 pages. **(61)**

Nylon tubing is illustrated in U.S. Gasket Co. bulletin (N-1056). **(62)**

Tygon flexible plastic tubing is illustrated in U.S. Stoneware Co. bulletin (T-97). 26pp. **(63)**

Tentative specifications for nylon pressure tubing is presented in a 4-page table from U.S. Gasket Co. **(64)**

Seamless boiler tubes—walls without welds—is the title of U.S. Steel Corp., National Tube Div. bulletin (No. 12). 40pp. **(65)**



Forged steel gate valves, completely new in design and compactly built for easy installation in cramped quarters are illustrated in Lunkenheimer Co. literature. Available in screwed or socket welding ends in sizes from ½ to 2 in. **(66)**

Jacketed valves, fittings and piping from Parks-Cramer Co. are presented in a 26-page spiral bound catalog. **(67)**

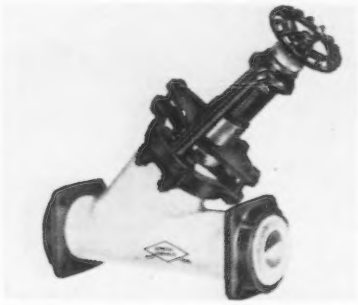
Slide gate pressure reducing valves, nylon disc gate valves, non-shock slow-closing valves, sliding gate temperature control valves, and many other types are illustrated in Jordan Corp. literature. **(68)**

Three-way diaphragm control valve specification sheet gives full details in 4 pages. From Minneapolis-Honeywell Regulator Co. Industrial Div. (Specification No. S810-16). **(69)**

High vacuum poppet and gate valves are illustrated in F.J. Stokes Corp. literature (ST-58-1 and 3). **(70)**

Valves, fittings, flanges and heat transfer equipment available from Henry Vogt Machine Co. are illustrated in company literature. **(71)**

Full line of 4,000 psi spring-loaded check valves designed for oil or raw water service are available from Sinclair-Collins Valve Co. **(72)**



Porcelain Y-valves give you three major advantages, according to General Ceramics Corp. literature—no lapping needed, no more fractured bodies, quick finger-touch adjustment. **(73)**

Koroseal polyvinyl chloride, self-lubricating ball valves are available from B.F. Goodrich Industrial Products Co. Sizes from ½ through 1½ in. **(74)**

Air-operated diaphragm control valve, Type 900, for precision control of hard-to-handle fluids, slurries, sludges, pulps and acids, has been developed by Uniflow Valve Corp. Available in many materials of construction. **(75)**

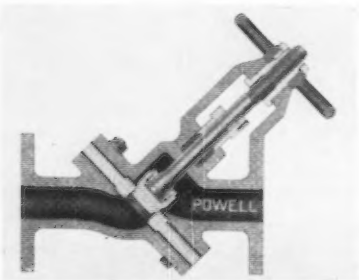
Swing check valves to protect against reverse flows in steam or water lines in sizes from 2 to 36 in. dia., are sold by Schutte & Koerting Co. **(76)**

Pinch type valves (Series "G" RKL) are available from RKL Valve & Mfg. Co. in sizes from 1- through 8-in. dia. Materials of construction include both pure gum and synthetic rubbers. Valve is for on-off service only. **(77)**

Ram type drain valves for processing vessel discharge can be examined through literature from Strahman Valves, Inc. 6pp. **(78)**

Corrosion-resistant Type F plug valves with Teflon sleeves in sizes from ¼ through 3 in. are available from Duriron Co., Inc. **(79)**

U-bolt gate valves in the Jenkins Bros. line are illustrated in 6-pager. **(80)**



Valves of all kinds—gate, globe, check, Y, flush-bottom tank, Bell-O-Seal, steam jacketed, liquid level, lubricated plug—in bronze, iron or steel are available from William Powell Co. **(81)**

Two types of dust collector discharge valves are illustrated in Ducon Co., Inc. literature. **(82)**

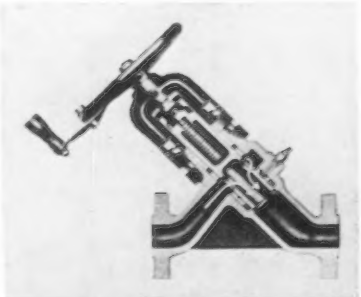
Stainless steel valves, fittings and accessories are illustrated in Cooper Alloy Corp. catalog No. 55D. 64pp. **(83)**

Corrosion and erosion resistant (Ni-Resist) gate valves from Jenkins Brothers are illustrated in a 6-page bulletin that presents a guide to many corrosive fluids (and operating temperatures) handled by Ni-Resist installations. **(84)**

Seatless piston valves, the seating ring made of asbestos, neoprene, Teflon or Kel-F, are available from Strahman Valves, Inc. Company says that the valve is ideal for chemicals and hard-to-hold liquids and gases. **(85)**

Rigid polyvinyl chloride valves and fittings in the Walworth Co. line can be examined through company literature. 16pp. **(86)**

Fluid control products—needle valves, panel mounting valves, metering and check valves, and many other types of valves and accessories are illustrated in Hoke Inc. catalog (Sec 11A 1, 9-57). **(87)**



Steam plant equipment—low pressure, medium and high pressure blow-off valves—are illustrated in Yarway-Waring Co. bulletin G-1308. 11pp. **(88)**

Bonnetless gate valve recently introduced by DeZurik Corp. is designed for handling fibrous, viscous or slurry type flows. Available in sizes from 3 through 24 in. **(89)**

Small cast steel valves for high pressure service, in angle and Y-globe design, for service on ¼ to 2-in. lines are available from Walworth Co., according to literature available. **(90)**

Rubber-lined swing check valves, in valve sizes from 3 through 20 in., are illustrated in Golden-Anderson Valve Specialty Co. bulletin (W-11). 4pp. **(91)**

Adjustable cam, lever-operated control valves for accurate metering of fuel oil in industrial oil burner installations can be examined through a flyer available from Atlas Valve Co. **(92)**

Rigid polyvinyl chloride Y-sediment strainer, made by Walworth Co. for corrosive service, is available in five sizes from ½ through 2 in. **(93)**

Rubber-covered one-wire braid hose for medium pressure service is illustrated in Parker Fittings & Hose Div., Parker-Hannifin Corp. catalog No. 4440. 6pp. **(94)**

Rubber expansion joints and flexible pipe are now available from General Rubber Corp. for vacuum or pressure service at up to 180 deg F in sizes from ½ through 72 in. I.D. Pressure rating is 150 psig or 30-in. vacuum. **(95)**

Fiberglass pipe fitting insulation in molded interchangeable matching halves is now being offered in sizes to fit all standard pipe fittings of every size by Fiberous Glass Products, Inc. **(96)**

Self-cleaning liquid strainers are illustrated in Golden Anderson Valve Specialty Co. literature. 4pp. **(97)**

Fluorocarbon products for valve, pump, hydraulic and pneumatic service are illustrated in Garlock Packing Co. Plastics Div. bulletin. 15pp. **(98)**

Welded fittings, forged flanges and other commercial forgings available from Tube Turns Div., National Cylinder Gas Co., are illustrated. **(99)**

Stainless steel fittings available from Cooper Alloy Corp. are presented in catalog No. 55F. 33pp. **(100)**

Corrosion resistant valves, fittings, castings and pumps bulletins available from Cooper Alloy Corp. are discussed in a 4-page abstract prepared by the company. Over 44 bulletins and catalogs are available. **(101)**

Type 316 stainless steel hose nipples are available in sizes from ¼x¼ to 1x1 in. from Band-It Co. **(102)**

Lightweight injection-molded unplasticized polyvinyl chloride pipe can be obtained from Tube Turns Plastics, Inc. Elbows, tees, couplings and caps in sizes from ¾ to 2 in. are available. Couplings also can be had in 3 and 4 in. dia. **(103)**

Quick coupling (Kamlok design) developed by Jordan Industrial Sales Div., OPW Corp. can be examined through an 8-page catalog (F-10-R). **(104)**

Fittings and hose for high pressure service in the Parker Hoze-lok-30 line can be examined through catalog No. 4430. 7pp. Parker Fittings & Hose Div., Parker-Hannifin Corp. **(105)**

For Your Files

This selected manufacturers' literature is free unless otherwise specified. If item is for sale, send request and money direct to manufacturer.

PHOTOGRAMMETRY — the shortest, most economical route to engineering design is the title of brochure available from Canadian Aero Services, Ltd. Typical examples of mapping for highways, railroads, town planning, etc., are included. **(113)**

DIESEL ENGINES, two new models by Allis-Chalmers Mfg. Co., are illustrated in a 16-page catalog (BU-413). Photos, cutaways and performance are shown. **(114)**

DIESEL POWERED crawler tractors —Allis-Chalmers Mfg. Co.'s HD-6— is described in 14-page bulletin (MS-1251). **(115)**

BOTTOM-DUMP motor wagon described in Allis-Chalmers Mfg. Co.'s 6-page catalog (MS-1269) is the Model TW-360. **(116)**

CRANE SHOVEL — the Koehring Co.'s 95-ton Model 1205 excavator with 3 cubic yd bucket—is illustrated in 24-page catalog. **(117)**

ROAD MACHINERY products in the Huber-Warco Co. line are detailed in a 32-page brochure. **(118)**

SCRAPER, Model TS-24, is presented in Euclid Division's 23-page bulletin (554). **(119)**

HEAVY-DUTY, cab-forward, all-wheel-drive trucks are presented in International Harvester Co.'s 8-page catalog (CR-205-G). **(120)**

THE WORK BULL and Davis industrial equipment are detailed in Massey-Ferguson Industrial Division literature. Tractor shovels and loaders. 26pp. **(121)**

SPECIALTY steels for the mining industry are introduced in Crucible Steel Co. of America's 12-page brochure. **(122)**

MANGANESE-STEEL chain catalog available from Taylor-Wharton Co. is 16 pages. **(123)**

ONE-USE DRILL BITS are described in Le Roi Div., Westinghouse Air Brake Co. bulletin. 6pp. **(124)**

RAINTIGHT circuit breaker load centers can be examined in General Electric Co.'s 12-page bulletin (GEA-6661A). NEMA Type 3R. Also note GEA-6173, a 23-page bulletin on aluminum plug-in busways Type DE, 225-1000 amp. **(125)**

MAGNETIC DRIVES from Whitney Chain Co. are illustrated in an 8-page bulletin (W-T 2 57). **(129)**

FLUID POWER, any-speed drives, are presented in Oilgear Co. bulletin (10600). 31pp. **(130)**

PUMP MOTORS from Reliance Electric & Engineering Co. are introduced in a 4-page bulletin. **(131)**

TOTALLY-ENCLOSED dc motors for contaminated atmospheres are illustrated in Allis-Chalmers Mfg. Co. bulletin (53B8904). 4pp. **(132)**

HEAVY-DUTY SERVICE COMPRESSORS in a non-lubricating design are illustrated in Ingersoll-Rand literature (Form 3251). Sizes from ½ to 2,000hp. **(133)**

CYLINDER MANIFOLDS for gases —the complete Airco line of Air Reduction Sales Co.—are illustrated in 20-page catalog (829). **(134)**

WELDING electrode accessories to connect from the electrode to the machine are illustrated in Tweco Products, Inc., literature (No. 11). 12pp. **(135)**

PORTABLE WELDER that supplies power also is presented in Lincoln Electric Co. bulletin. 4pp. **(136)**

HIGH-SPEED synchronous generators, from 30 to 300kw, are detailed in Allis-Chalmers Mfg. Co. bulletin (51B8909). 4pp. **(137)**

REGULATORS for all industrial gases are described in Linde Co.'s Oxweld apparatus catalog (section 2). 20pp. **(138)**

SOLID FILM LUBRICANTS developed by Electrofilm are presented in detail in a 16-page catalog. **(139)**

PACKAGED AUTOMATIC BOILERS, including the new Model 5, can be examined in Ore & Sembower, Inc., literature. **(140)**

IMPACT CRUSHER, Kennedy Van Saun's Cuber Junior, is illustrated in a bulletin (D-1006). Capacities up to 250 tph possible. **(141)**

PRESSURE REGULATORS and how to select them is the title of a 28-page bulletin prepared by Kiely & Mueller, Inc. Bulletin No. 401. **(142)**

AGITATORS for thick slurries (even cement) are presented in Manitowoc Shipbuilding, Inc., bulletin. 9pp. **(143)**

HOW ANIONIC REAGENTS can float silica sand is the title of Armour Chemical Division's bulletin of fatty acids and their derivatives. 7pp. **(144)**

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Please send me the catalogs or further information about the items from New Products Digest whose numbers are circled. **MAY 1958**

1	17	33	49	65	81	97
2	18	34	50	66	82	98
3	19	35	51	67	83	99
4	20	36	52	68	84	100
5	21	37	53	69	85	101
6	22	38	54	70	86	102
7	23	39	55	71	87	103
8	24	40	56	72	88	104
9	25	41	57	73	89	105
10	26	42	58	74	90	106
11	27	43	59	75	91	107
12	28	44	60	76	92	108
13	29	45	61	77	93	109
14	30	46	62	78	94	110
15	31	47	63	79	95	111
16	32	48	64	80	96	112

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114	128	142	156	170
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126	140	154	168	182

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E&MJ NEW PRODUCTS DIGEST (*Continued*)

PARTICLE SIZE ANALYZER — Mine Safety Appliances Co.'s design—is described in 4-page bulletin (No. 0708-1). **(146)**

DEMINERALIZERS in the Graver Water Conditioning Co. line can be examined in a 29-page bulletin (WC-111A). **(147)**

EQUIPMENT designed for processing —size reduction, mixing, blending and separating—are presented in a Strong Scott Mfg. Co. catalog. **(148)**

RESEARCH and pilot plant drying and calcining equipment from C. O. Bartlett & Snow Co. is illustrated in 6 pages. **(149)**

PROCESSING equipment in porcelain, stoneware, alumina, Chemplas 15 and graphite are illustrated in General Ceramics Corp. bulletin (CHE-R6). 15pp. **(150)**

SINGLE ROLL CRUSHER—McLanahan & Stone Corp.'s Black Diamond —is detailed in an 8-page catalog (FSBD-158). **(151)**

CUSTOM FABRICATION of processing equipment is the subject of Niagara Welding & Boiler Works, Inc., literature. **(152)**

LEAD-LINED processing equipment can be obtained from Lead Lined Iron Pipe Co. according to their 35-page pipe and valve catalog. **(153)**

LIGHTNING MIXERS process industries catalog (B-109) is 13 pages. **(154)**

LABORATORY MACHINERY from Morse Bros. Machinery Co. is four pages. **(155)**

FULLY AUTOMATIC electric packaged controls are detailed in Hays Corp. bulletin (57-1088-239). 10pp. **(156)**

LABORATORY APPARATUS catalog from Eberback Corp. list over 250 items in 43 pages. **(157)**

PERMANENT MAGNETIC DRUM separator developed by F. W. Shrader Co. is illustrated in literature available. **(158)**

INFRARED ANALYZERS, Beckman Process Instruments Division Models 15-A and 21, are described in a 6-page bulletin (IR-4005). **(159)**

PYROMETER line of equipment available from Pyrometer Instrument Co., Inc., is illustrated in an 8-page catalog (No. 175). **(160)**

HIGH-RESOLUTION PMR X-ray microscope with electron microscope conversion features is displayed in Philips Electronics, Inc., folder. **(161)**

REFRACTORY COATINGS from Saverite Engineering Co. can be examined through Technical Bulletin No. 31. **(162)**

ELECTROLYTIC HYGROMETER from Beckman Process Instruments Division are detailed in a 4-page release. **(163)**

PYROMETER SUPPLIES buyers' guide G100-8 from Minneapolis-Honeywell Brown Instrument Division is 52 pages. **(164)**

THERMOMETERS — indicating, recording and controlling—from Minneapolis-Honeywell Brown Instrument Division are presented in 53-page catalog (C-60-2). **(165)**

THERMAL CONDUCTIVITY gas analyzer developed by Beckman Process Instruments Division is illustrated in 4-page bulletin. **(166)**

ELECTRO-CHEMOGRAPH for polarographic analysis is described in Leeds & Northrup Co. data sheet E-94(3). **(167)**

MATERIAL HANDLING and conveyor catalog (MF-100) is available from May-Fran Engineering, Inc. **(168)**

HEAT EXCHANGERS in the Ross Heat Exchanger line are illustrated in Bulletin No. 1.1K6. 8pp. **(169)**

HEAT TRANSFER AND CRYSTALLIZATION is the title of Swenson Evaporator Co. publication. Thorough. 52pp. **(170)**

AIR ENGINEERING for process industries is the title of Niagara Blower Co. literature on heat exchangers, moisture and temperature regulators. **(171)**

BREAKTHROUGH in condensate purification, a reprint from *Combustion*, is available from Graver Water Conditioning Co. 8pp. **(172)**

METALLURGICAL applications of the rare earths is the title of a 10-year literature survey conducted by Rare Earths Div., Davison Chemical Co. Div., W. R. Grace & Co. Principal applications and literature sources included in 46 pages. **(173)**

BERYLLIUM, present and potential uses by Lawrence F. Boland, Beryllium Corp. is a 15-page booklet. **(174)**

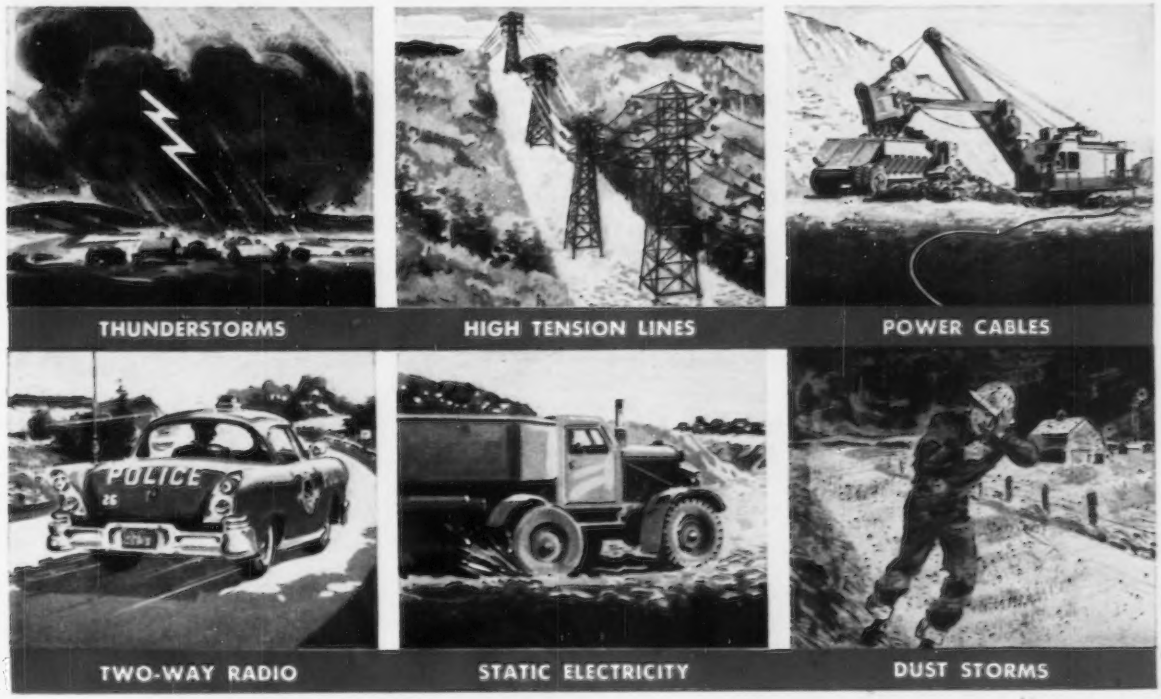
THERMALASTIC insulating system for motor winding is illustrated in Westinghouse Electric Corp.'s 10-page release. **(175)**

TIMBER FABRICATION, a 10-page booklet prepared by Rosboro Lumber Co., features many different types and uses of prefabricated lumber and timber. **(176)**

STEEL BUILDINGS available from Parkersburg Rig & Reel Co. are illustrated in a 16-page catalog. **(177)**

WATER TREATMENT equipment in the Permutit Co. Div., Pfaudler Permutit, Inc., line can be examined through a 12-page bulletin (4433). **(178)**

Guard against these stray current hazards!



Hook-up and detonate with Primacord!

Blasting authorities recommend the use of Primacord wherever extraneous electricity may be encountered. These unwanted electrical currents can be caused by lightning several miles away — by static due to moving belts, automobile tires, dust storms and even snow storms. Two-way radios, high tension lines and power equipment cables all present stray current hazards.

With Primacord as the detonating agent, you can load and fire when ready without danger from stray currents. Primacord is relatively safe to handle and store. It cannot be set off by *normal* vibration or friction, ordinary impact or sparks, but must be detonated with fuse and cap or electric blasting cap. It is not affected by stray electrical currents, and — according to all available records — has never been fired prematurely by lightning.

Your explosives supplier can give you further information and service. Use coupon for a free copy of the Primacord Sample Kit.

THE ENSIGN-BICKFORD COMPANY
Simsbury, Connecticut

Please send me the Primacord Sample Kit, free.

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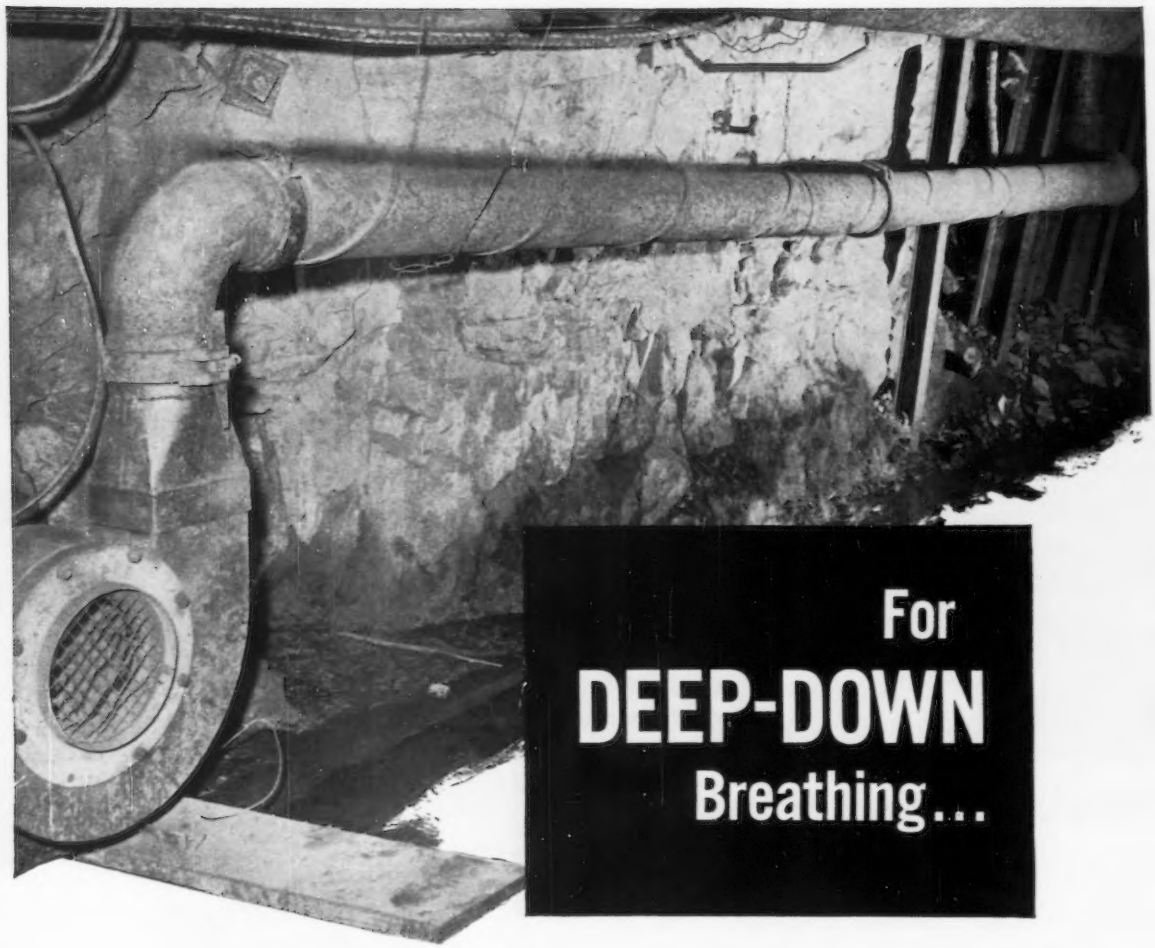
P-a



For DEEP-DOWN Breathing...

Lines of NAYLOR Spiralweld pipe are "just what the doctor ordered" for exhausting smoke, dust and fumes, and assuring plenty of fresh air in underground operations.

To begin with, this distinctive pipe is light in weight. This makes for easier handling and installation—especially when you speed connections with the one-piece NAYLOR Wedgelock coupling. Moreover, you can count on greater collapse strength and safety, due to the spiral-lockseam structure, which makes possible the use of lighter gauge material for real economy in ventilating service.

Anyway you figure, it will pay you to consider the extra performance built into NAYLOR pipe—for moving air, water or tailings.

To get the complete story, write for Bulletin No. 507.

NAYLOR

NAYLOR PIPE COMPANY

1243 East 92nd Street, Chicago 19, Illinois

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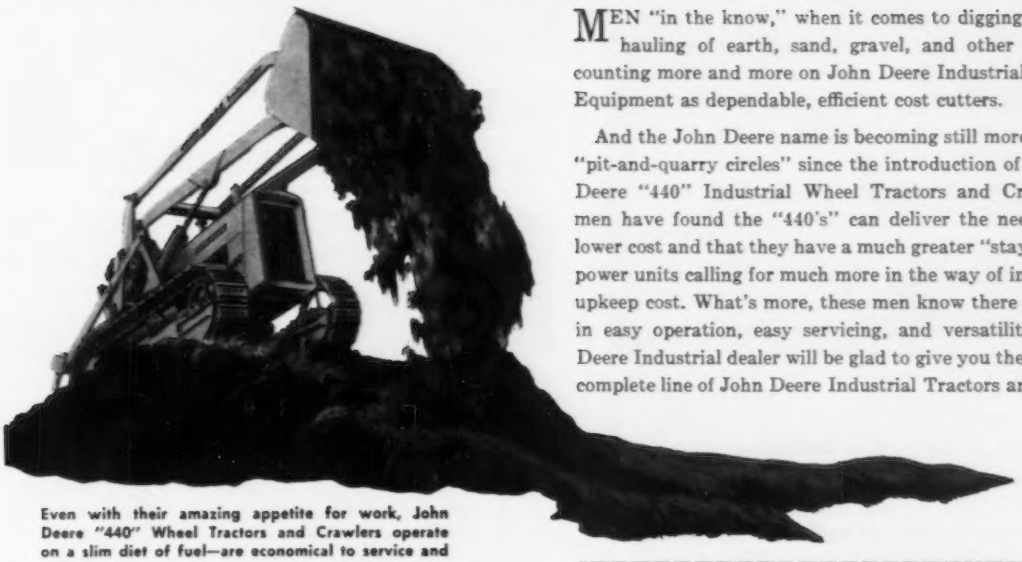
Famous for Delivering SO MUCH *for* SO LITTLE *for* SO LONG

This team, the John Deere "820" Diesel Tractor and the 8-yard Hancock Scraper do a speedy, low-cost job of moving overburden, sand, or gravel. The efficiency and dependability of this outfit have won the approval of experienced operators everywhere.

JOHN DEERE *Industrial* TRACTORS



Even with their amazing appetite for work, John Deere "440" Wheel Tractors and Crawlers operate on a slim diet of fuel—are economical to service and maintain.

MEN "in the know," when it comes to digging, loading, and hauling of earth, sand, gravel, and other materials are counting more and more on John Deere Industrial Tractors and Equipment as dependable, efficient cost cutters.

And the John Deere name is becoming still more prominent in "pit-and-quarry circles" since the introduction of the new John Deere "440" Industrial Wheel Tractors and Crawlers. These men have found the "440's" can deliver the needed power at lower cost and that they have a much greater "stay ability" than power units calling for much more in the way of initial price and upkeep cost. What's more, these men know there are "bonuses" in easy operation, easy servicing, and versatility. Your John Deere Industrial dealer will be glad to give you the details on the complete line of John Deere Industrial Tractors and Equipment.

JOHN DEERE Industrial Tractors and Equipment

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Please send me free literature on the ☐ John Deere "820" Diesel, ☐ "440" Wheel Tractors, "440" Crawlers, ☐ Hancock Scraper.

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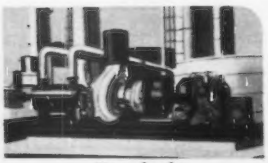
Four amazing advantages of Solar Gas Turbine Engines

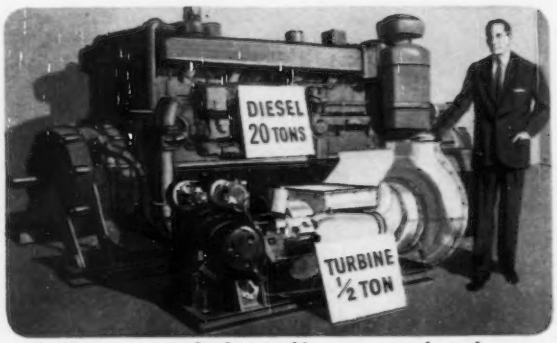
Gasoline—any kind.



Diesel oil

Kerosene.

Natural gas.



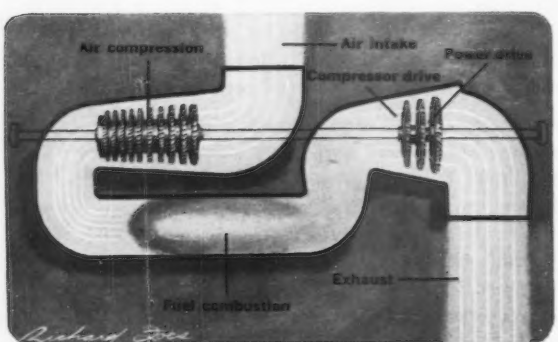
The Jupiter is completely portable—saves weight and space.

❶ Uses whatever fuel you've got!

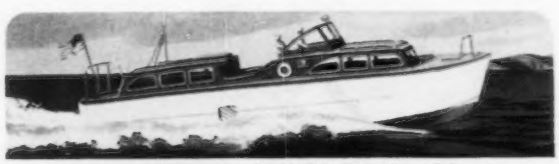
Solar gas turbines can operate on almost any available fuel—fuel that costs the least for *your* particular operation. Located in remote areas, for instance, self-sufficient Solar turbines can take fuel directly from a gas pipeline! This often results in lower total operating costs.

❷ Light—500 hp in 1/5 the space!

Solar's 500 hp Jupiter® engine is only one-fifth the size of a diesel of similar horsepower—and weighs *forty times less!* The entire unit is easily transported to remote locations. And it is especially suited to applications where space limitations create a troublesome installation problem.



Few moving parts, no reciprocation—longer life.



Instant acceleration—takes full load without laboring.

Instant emergency power.

Starts in any climate.

❸ Simple design—low maintenance!

Gas turbines are the simplest of all heat engines. In operation, large volumes of air are drawn in by the compressor, mixed with fuel in the combustion chamber, greatly expanded, and delivered to a turbine which produces shaft power. Routine servicing can be completed in a few hours at most. Overhauls are infrequent. Simple design and low maintenance make gas turbines ideal for a wide range of important applications—including boat propulsion, portable power generation, air compression and chemical processing. And other applications for these versatile power plants of the future are limited only by the imagination.

❹ Starts instantly—no warm-up!

Solar gas turbines can be turned on or shut down in seconds. And they require no warm-up—even after long periods of stand-by service. No matter what your business, no matter what your power needs, these amazing advantages can benefit you. Write to Dept. F-17, for free gas turbine brochure.

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"IN CASE OF EMERGENCY"

Mine emergencies happen without warning . . . and when they do happen, equipment that carries the "in case of emergency" label suddenly becomes vital to fire fighting and rescue efforts. Breathing protection devices are a major part of emergency mine equipment.

Below is a check list of this equipment offered by MSA. If you would like to make sure your emergency program is up-to-date, why not have our representative check your requirements and suggest a regular inspection and maintenance schedule.

M-S-A McCAA® Oxygen Breathing Apparatus—
gives complete breathing protection in any unbreathable atmosphere for a minimum of two hours. Used under the hardest physical conditions . . . in fighting and sealing fires, re-establishing ventilation, and rescue operations. U. S. Bureau of Mines approved.

M-S-A Chemox®—
allows complete breathing protection in any gaseous or oxygen deficient area for a minimum of 45 minutes. Generates its own oxygen supply from replaceable canister. Weighs only 13½ lbs. U. S. Bureau of Mines approved.

M-S-A All-Service Mask®—
assures safe, comfortable breathing protection against smoke and toxic gases including carbon monoxide—singly—or in combination where there is sufficient oxygen to sustain life. U. S. Bureau of Mines approved.

M-S-A Self-Rescuer®—
a miniature mask for use in deadly carbon monoxide following fire or explosion. Gives the miner precious minutes of emergency breathing protection. Unit is compact, lightweight; may be stored in quantity underground or carried individually. U. S. Bureau of Mines approved.

M-S-A Air and O_2 Mask—
designed for 30 minutes maximum breathing protection in any atmosphere—supplies air or oxygen in exact accordance with breathing requirements. Flow ceases during exhalation for added economy. Comfortable to wear and easy to use.

M-S-A Pneolator®—
provides automatic artificial respiration that assures maximum chances of recovery for victims of poisonous gases, electrical shock, heart attacks, or other causes of asphyxia. Housed in compact, lightweight glass fiber case.

MSA
SAFETY EQUIPMENT HEADQUARTERS

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201 North Braddock Avenue, Pittsburgh 8, Pa.
At Your Service: 77 Branch Offices in the United States and Mexico

MINE SAFETY APPLIANCES CO. OF CANADA, LTD.
Toronto, Montreal, Calgary, Edmonton, Winnipeg, Vancouver, Sydney, N.S.

Yieldable Arch can be installed as the drift is being driven

These workmen illustrate another special advantage of Bethlehem's yieldable mine roof support: they're installing Yieldable Arch sets right next to the breast of the drift. That means the overburden is brought under immediate permanent control, without the time and expense of temporary roof support.

And we do mean *control*, for as soon as the surrounding forces bear down too hard, the Yieldable Arch will give a little instead of collapsing. This allows the overburden to settle gradually until it forms a natural pressure arch around the mine opening.

The Yieldable Arch works on a sliding joint principle, with friction the determining factor. Nestable segments of U-shaped rolled steel are overlapped at the ends, and these joints are secured with heavy U-bolt clamps which are drawn up tightly enough to hold fast under normal loads. Excessive pressure, however, overcomes the friction in the joint, causing the arch to yield. The load is thus relieved and the structural integrity of the arch is maintained.

Horizontal braces or struts tie one arch set to the succeeding one to provide lateral stability to the structure. Blocking and packing between the lagging and roof are recommended to distribute loads evenly.

Bethlehem engineers have acquired considerable experience in the use, installation and maintenance of Yieldable Arches, and would be glad to apply their experience to your mine-roof problems. A visit to your workings would, of course, be helpful and we would welcome the opportunity whenever it is convenient for you.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

95 PAYHAULER® FLEET *speeds load-delivery 50%*

. . . for Central Pa. Quarry, Stripping, and Construction Co., Hazelton, Pa.

Relocating 1.9 miles of U.S. 40, east of Flintstone, Maryland, Central Pennsylvania Quarry, Stripping, and Construction Co. is moving 1,200,000 cu. yd.—90% of it rock—with five International 95 Payhaulers!

The terrain requires the deepest cut (146 feet), and highest fill (150 feet), in Maryland. The haul is 4,000 feet, with dangerous downgrades exceeding 25%.

Their Payhauler fleet is operating beside competitive haulers down the same steep haul-road. This permits accurate ton-for-ton, and penny-for-penny performance comparisons.

Here's what Job Supt. Harry G. Smith reports:

"Delivery time halved"

"The '95's' have cut costs of hauling large payloads because Torqmatic braking has cut delivery time in half over the other machines." A fully-loaded Payhauler can go down the steep grades much faster than a conventionally-braked hauler. With complete safety, too!

See how Torqmatic braking gives positive load control at any practical speed—on any grade. Try "95" get-away and climb-out speed, with the wallop of 335 turbocharged diesel "horses." Measure planetary drive axle shock-absorbing advantages. Prove production-boosting Payhauler operating ease. See your International Construction Equipment Distributor for a demonstration!

"Operators particularly like '95' operating ease, riding comfort, and maneuverability," states Job Superintendent Smith. No wonder! Controls are conveniently located. Modern power steering reduces muscle strain! Shock-swallowing seat gives "club car" riding ease!

International® *Construction Equipment*

International Harvester Co., 180 N. Michigan Avenue, Chicago 1, Illinois

A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors . . . Self-Propelled Scrapers . . . Crawler and Rubber-Tired Loaders . . . Off-Highway Haulers . . . Diesel and Carbureted Engines . . . Motor Trucks . . . Farm Tractors and Equipment.

"TAKE IT FROM ME... International® crawler is 'toughest', faster...for manganese mining!"

BRYON J. PHEGLEY, Superintendent, Duncan Mining Company

The authority of long experience with other leading makes of track-type tractors, backs the statement by Bryon J. Phegley, superintendent for Duncan Mining Company, Mena, Arkansas.

"I have been mining for 28 years," states Mr. Phegley, "but I don't know of any rougher tractor work than this. The International tractor is toughest and much faster than others I've used. It gives very good service."

Blasting brings down boulders that stump the ¾ cu yd shovel and block the haulers. The boss simply calls in their dozer-equipped TD-18. And in 15 minutes, or so, the pit face is clean, the haul road clear, so manganese ore mining can be resumed.

Rock-shock imposes tremendous impact loads on track frames. That's where box-section track frames, inside braced with inch-thick steel prove their stuff!

Powdery grit particles, as abrasive as grinding compound, gnaw at track parts. Electronic hardening puts a deep wear-fighting armor on track links. International track roller seals do a positive job of excluding grit from bearings—besides extending lubrication intervals up to 50 days!

Features like these are why the International crawler gives amazingly dependable performance—handling key jobs that help the mine profitably produce 1,000 tons of manganese ore per week!

For your own profit and satisfaction, discover why so many quarry-men and miners are switching to International crawlers — especially for the tough jobs like rock-moving. See your International Construction Equipment Distributor for a demonstration!

After pit clean-up, the International crawler resumes moving truck-hauled overburden out of the way. In addition to these jobs, the big crawler maintains haul roads.

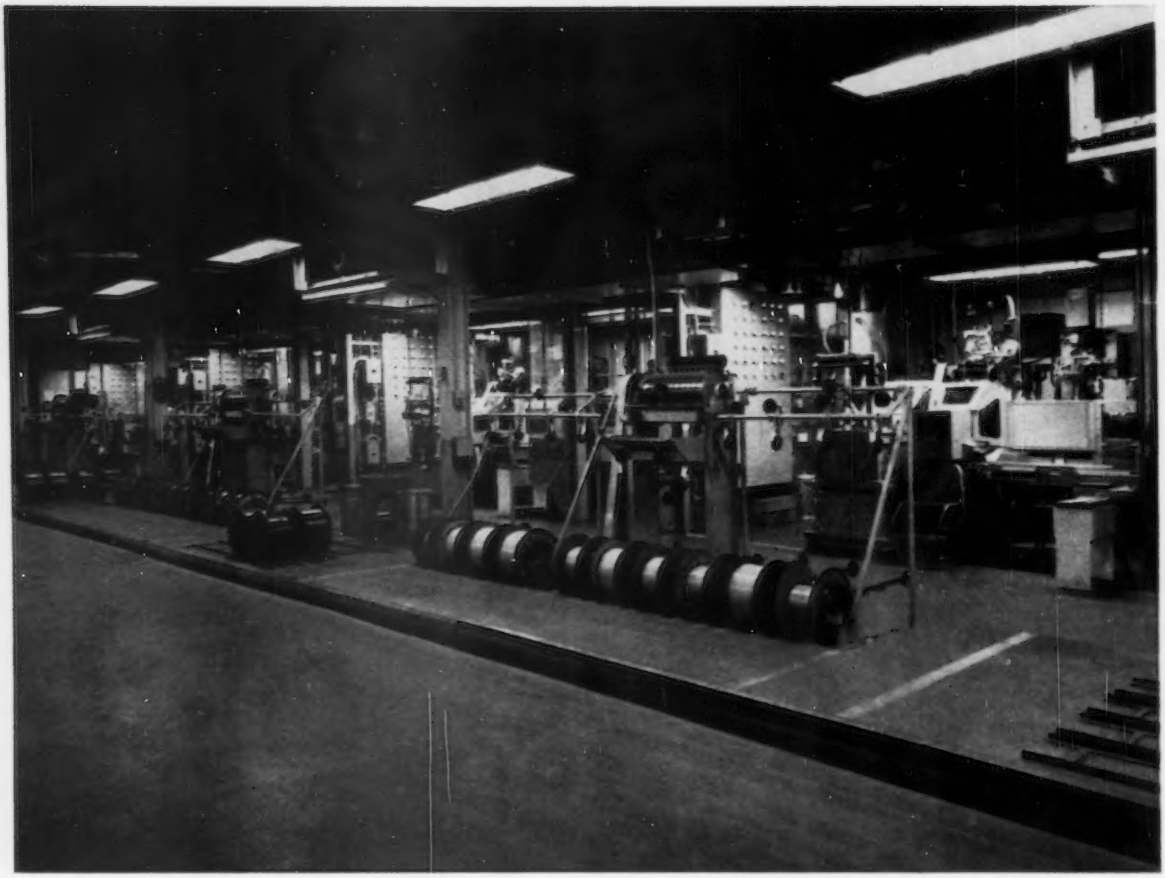
Typical extra assignment for the International crawler: carving out a new haul road into the pit to reach a new vein of manganese 30 ft. below the level of the present pit floor. This road is to be 225 ft. long, 30 ft. deep, and 30 ft. wide.

International® Construction Equipment

International Harvester Co.,
180 North Michigan Ave., Chicago 1, Ill.

A COMPLETE POWER PACKAGE:
Crawler and Wheel Tractors . . . Self-Propelled Scrapers . . . Crawler and Rubber-Tired Loaders . . . Off-Highway Haulers . . . Diesel and Carbureted Engines . . . Motor Trucks . . . Farm Tractors and Equipment.

One of Duncan Mining's toughest jobs is clean-up after blasting. Their International crawler easily muscles the king-size boulders and chunks of shale from the pit to overburden dump.



A view of the fully automatic assembly line at Pompton Lakes, N. J., where Du Pont Electric Blasting Caps, both regular and delay, are completely assembled by electronically-operated machinery.

Du Pont announces the first 100% mechanically assembled electric blasting caps

to assure you even more uniform, more reliable products

Here, in the only factory of its kind, Du Pont Electric Blasting Caps are now made on fully automatic machinery to give you the utmost in reliability, uniformity, and dependability.

Every step in the process, from automatically loading the shell (and inspecting it 3 times during loading alone), to applying the shielded shunt and paper band is electronically controlled.

This revolutionary approach means that every Du Pont Electric Blasting Cap—regular or delay—*must* meet our rigid standards at *every step* or it will be automatically rejected by one of the dozens of electronically controlled "watchmen."

This elimination of the human equation means that all Du Pont Electric Blasting Caps are even more uniform, more reliable, more dependable than ever before.

And you get all these benefits at NO INCREASE IN COST. Call your Du Pont representative or write to E. I. du Pont de Nemours & Co. (Inc.), Wilmington 98, Delaware.

DU PONT BLASTING CAPS

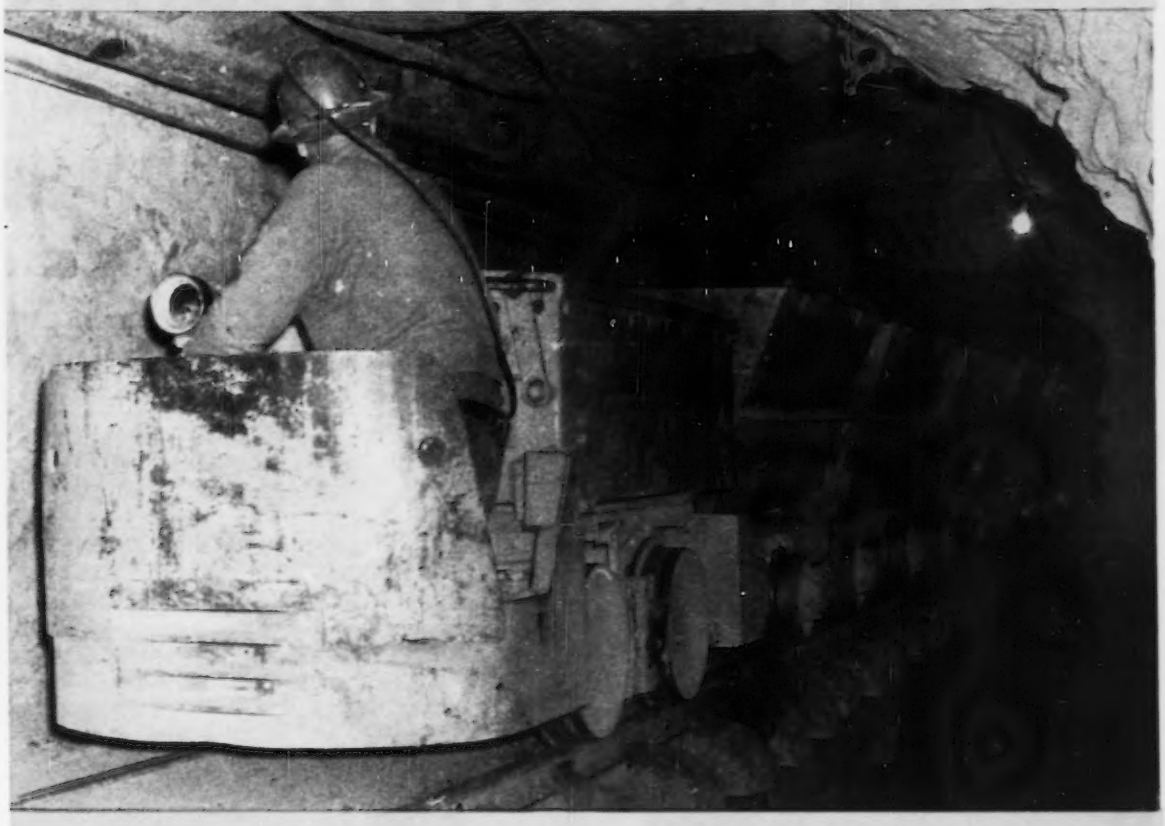
Products of Du Pont Research

DU PONT

REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

MANCHA STORAGE BATTERY LOCOMOTIVE



Expediting Track Haulage of Uranium Ore

In the uranium rich areas of the Colorado Plateau and Canada's Blind River District 25 recently delivered Mancha 3-ton storage battery locomotives are providing low cost underground haulage.

Practical anywhere underground, these locomotives are maneuverable enough to service loaders in development headings . . . powerful enough to handle small mine production tonnage. Six to ten rocker dump cars, each carrying 1½ to 2 tons of ore is not an unusual load, and 150 tons per shift over a distance of 1,000 feet is just another job to them.

Mancha's patented Trackmaster design smooths out uneven track . . . cushions the battery as well as the motorman from a rough ride. More so, it improves overall performance by providing even drawbar pull to all four wheels through longitudinal equalizers and self-aligning journal bearings. The motor in the front end cast steel cab, is hooded to shed water and muck. A similar hood protects the controller.

In all respects, the Titan BN (3-ton operating weight) is a powerful—safe locomotive. What it provides in haulage economy for others, it can provide for you. Your inquiry is invited.

MANCHA STORAGE BATTERY LOCOMOTIVE

DIVISION GOODMAN MANUFACTURING COMPANY

Halsted Street and 48th Place • Chicago 9, Illinois • Cable Address: Mancha, Chicago

Mancha representatives are located in principal mining areas throughout the world.

STURDY CONSTRUCTION,

mean savings down the line with

TABLE 1

Belt width, inches	Capacity in tons per hour at belt speed of 100 FPM			Maximum lump size, inches		Maximum recommended belt speed, FPM	
	Wt. of material, lbs. per cu. ft.			Sized	Unsized	Half max. size lumps	Max. size lumps
	50	75	100				
18	27	40.5	54	3	5	400	300
24	50	75.0	100	4-1/2	8	500	400
30	81	121.5	162	7	10	600	450
36	117	176.0	235	8	12	650	500

TABLE 2.

Weight of material, lbs. per cu. ft.	Belt width, inches	Capacity, tons per hour											
		Belt speed, feet per minute											
		100	150	200	250	300	350	400	450	500	550	600	650
50	18	27	40	54	67	81	94	108					
	24	50	75	100	125	150	175	200	225	250			
	30	81	121	162	202	243	283	324	364	405	445	486	
	36	117	176	235	293	352	411	470	528	587	645	704	763
75	18	40	60	80	100	121	141	162					
	24	75	112	150	187	225	262	300	337	375			
	30	121	181	242	302	363	424	486	545	605	665	726	
	36	176	264	352	440	528	616	705	792	880	968	1056	1144
100	18	54	81	108	135	162	189	216					
	24	100	150	200	250	300	350	400	450	500			
	30	162	243	324	405	486	567	648	729	810	891	972	
	36	235	352	470	587	705	822	940	1057	1175	1292	1410	1527

For applications handling materials weighing more than 100 pounds per cubic foot, or extremely abrasive material, refer problem to plant engineers for proper recommendations, belt and idler selection, etc.

THESE pre-engineered selection tables are your head start to savings with Link-Belt PRE-BILT sectional belt conveyors. In ordering, in estimating, in purchasing and other steps as well—comparable cost shortcuts add up to substantial savings. And rugged design throughout keeps maintenance costs down even under severe operating conditions.

For complete facts and application data on Link-Belt PRE-BILT conveyors up to 36-in. wide—with drives up to 40 hp and 24 or 42-in. truss depths, contact your nearby Link-Belt office.

This installation is typical of the exceptionally rugged construction and versatile application of Link-Belt PRE-BILT belt conveyors.

NO DETAILED DRAWINGS — From standardized data, a Link-Belt engineer will prepare an "on-the-site" quotation covering the components for your needs.

LOWER PURCHASING COSTS — Interchangeability and standardization lower costs and speed selection of parts . . . all available from Link-Belt.

STANDARDIZED SELECTION...

Link-Belt PRE-BILT sectional belt conveyors

TABLE 3. Horsepower to drive empty conveyor.

Belt Width Inches	Horsepower to drive empty conveyor for each 100 FPM belt speed											
	Conveyor centers, feet											
	50	100	150	200	300	400	500	600	700	800	900	1000
18	.20	.30	.35	.40	.50	.60	.70	.80	.90	.95	1.00	1.20
24	.30	.40	.50	.60	.70	.85	1.00	1.20	1.40	1.50	1.60	1.70
30	.40	.50	.70	.85	.95	1.10	1.30	1.50	1.70	1.90	2.10	2.30
36	.50	.60	.80	1.00	1.20	1.40	1.60	1.80	2.00	2.20	2.40	3.00

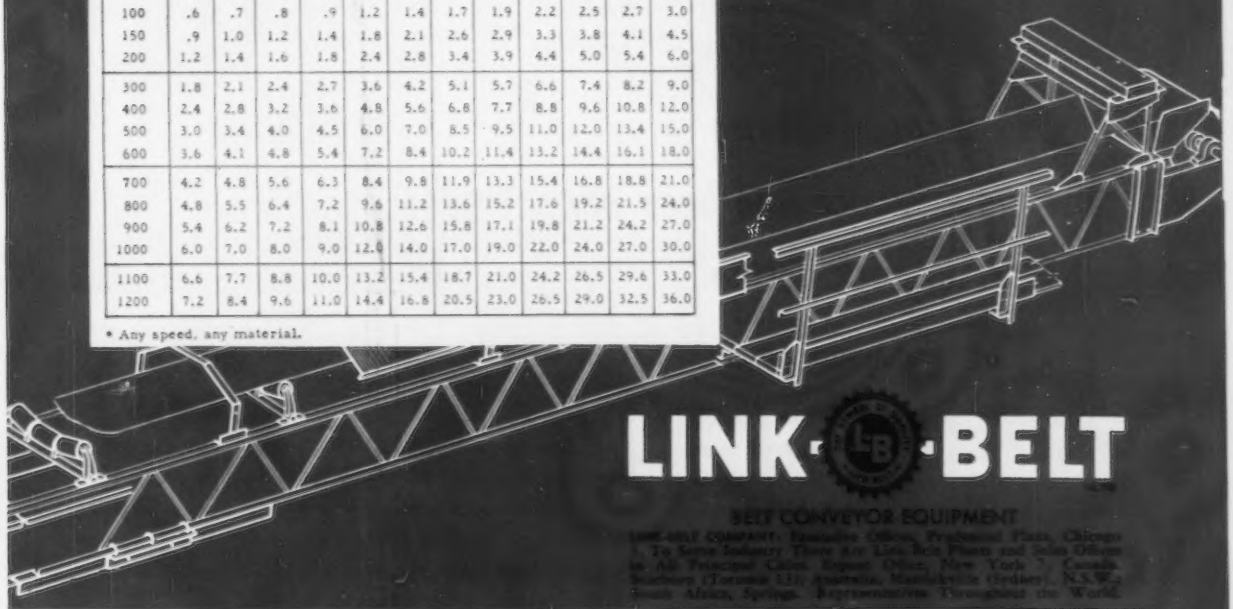
TABLE 4. Horsepower to convey material horizontally.

Tons per hour	Horsepower to convey material horizontally*											
	Conveyor centers, feet											
	50	100	130	200	300	400	500	600	700	800	900	1000
50	.3	.4	.5	.6	.7	.8	.9	1.0	1.1	1.2	1.4	1.6
100	.6	.7	.8	.9	1.2	1.4	1.7	1.9	2.2	2.5	2.7	3.0
150	.9	1.0	1.2	1.4	1.8	2.1	2.6	2.9	3.3	3.8	4.1	4.5
200	1.2	1.4	1.6	1.8	2.4	2.8	3.4	3.9	4.4	5.0	5.4	6.0
300	1.8	2.1	2.4	2.7	3.6	4.2	5.1	5.7	6.6	7.4	8.2	9.0
400	2.4	2.8	3.2	3.6	4.8	5.6	6.8	7.7	8.8	9.6	10.8	12.0
500	3.0	3.4	4.0	4.5	6.0	7.0	8.5	9.5	11.0	12.0	13.4	15.0
600	3.6	4.1	4.8	5.4	7.2	8.4	10.2	11.4	13.2	14.4	16.1	18.0
700	4.2	4.8	5.6	6.3	8.4	9.8	11.9	13.3	15.4	16.8	18.8	21.0
800	4.8	5.5	6.4	7.2	9.6	11.2	13.6	15.2	17.6	19.2	21.5	24.0
900	5.4	6.2	7.2	8.1	10.8	12.6	15.8	17.1	19.8	21.2	24.2	27.0
1000	6.0	7.0	8.0	9.0	12.0	14.0	17.0	19.0	22.0	24.0	27.0	30.0
1100	6.6	7.7	8.8	10.0	13.2	15.4	18.7	21.0	24.2	26.5	29.6	33.0
1200	7.2	8.4	9.6	11.0	14.4	16.8	20.5	23.0	26.5	29.0	32.5	36.0

* Any speed, any material.

TABLE 5. Horsepower to elevate material

Tons per hour	Horsepower to elevate material									
	Lift, in feet									
	10	20	30	40	50	60	70	80	90	100
50	.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.6	5.1
100	1.0	2.0	3.0	4.0	5.1	6.1	7.1	8.1	9.1	10.1
150	1.5	3.0	4.5	6.1	7.6	9.1	10.6	12.1	13.7	15.2
200	2.0	4.0	6.1	8.1	10.1	12.1	14.2	16.2	18.1	20.0
300	3.0	6.1	9.1	12.1	15.2	18.2	21.1	24.0	27.0	30.0
400	4.0	8.1	12.1	16.2	20.0	24.0	28.0	32.0	36.0	40.0
500	5.1	10.1	15.2	20.0	25.0	30.0	35.0	40.0		
600	6.1	12.1	18.2	24.0	30.0	36.0				
700	7.1	14.1	21.0	28.0	35.0					
800	8.1	16.2	24.0	32.0	40.0					
900	9.1	18.2	27.0	36.0						
1000	10.1	20.0	30.0	40.0						
1100	11.1	22.0	33.0							
1200	12.1	24.0	36.0							



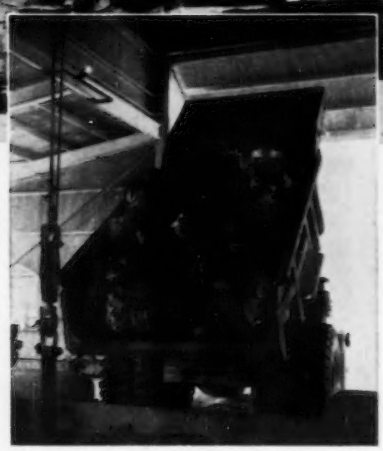
LINK-BELT

BELT CONVEYOR EQUIPMENT

NO COSTLY DELIVERY DELAYS—PRE-BILT conveyors are built at eight strategic locations and are shipped from the plant nearest you to assure prompt delivery.

QUICK-LOW COST INSTALLATION — Simple construction and shop-assembled components facilitate field assembly and installation by your own or Link-Belt erectors.

MINIMUM OPERATING COST— These conveyors require a minimum of power for the tonnages of materials handled. Maintenance normally consists only of lubrication.



"Euclids give us good service with low maintenance and keep our hauling costs at rock bottom"

LOUISVILLE CEMENT COMPANY, SPEED, INDIANA

Six 22-ton Euclid Rear-Dumps are hauling mortar stone, Portland cement stone and overburden at the Speed, Indiana, quarry of Louisville Cement Company. Working an 8 hour shift, three of these "Eucs" handle 400 tons per hour on hauls ranging from 1000 to 3000 feet. The wide bodies with struck capacity of 15 yards are loaded by a 4½ yd. shovel in four passes. Two other units are loaded by a 2½ yd. shovel. With loaded speeds up to 30 mph, they average 80 tons per hour on a 2 mile one-way haul. In addition, three of these "Eucs" work a second shift hauling overburden.

Louisville Cement Co., like hundreds of mine and quarry operators, has found that Euclid equipment moves more tons at lowest operating and maintenance cost. Dependable Euclid performance is the result of advanced engineering, rugged construction and almost 25 years experience with off-highway haulers.

To be sure you have the most economical hauling equipment, get a production and cost estimate from your Euclid dealer on the model best suited to your work — you'll find there are a lot of reasons why ***Euclids are your best investment.***

EUCLID DIVISION GENERAL MOTORS CORPORATION, Cleveland 17, Ohio

GM GENERAL MOTORS EUCLID

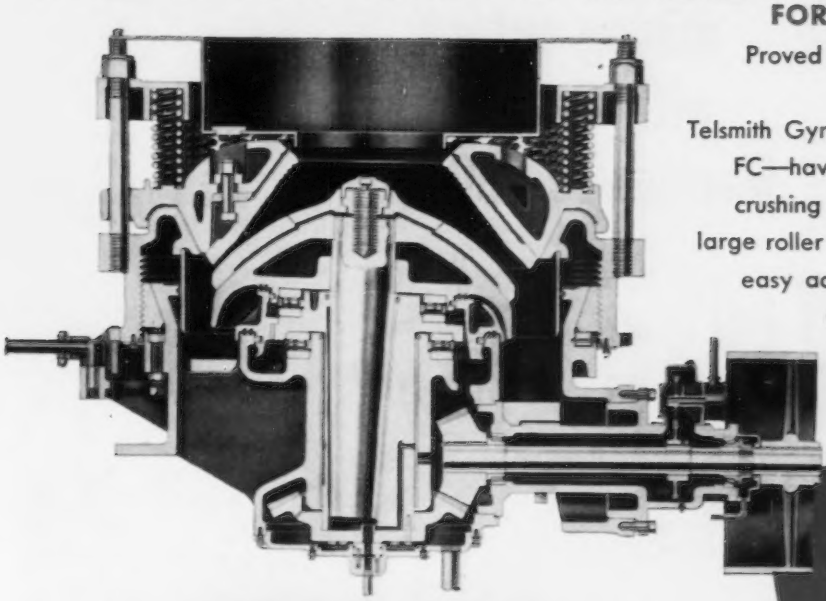
EUCLID EQUIPMENT

FOR MOVING EARTH, ROCK, COAL AND ORE

TELSMITH *Gyraspheres*

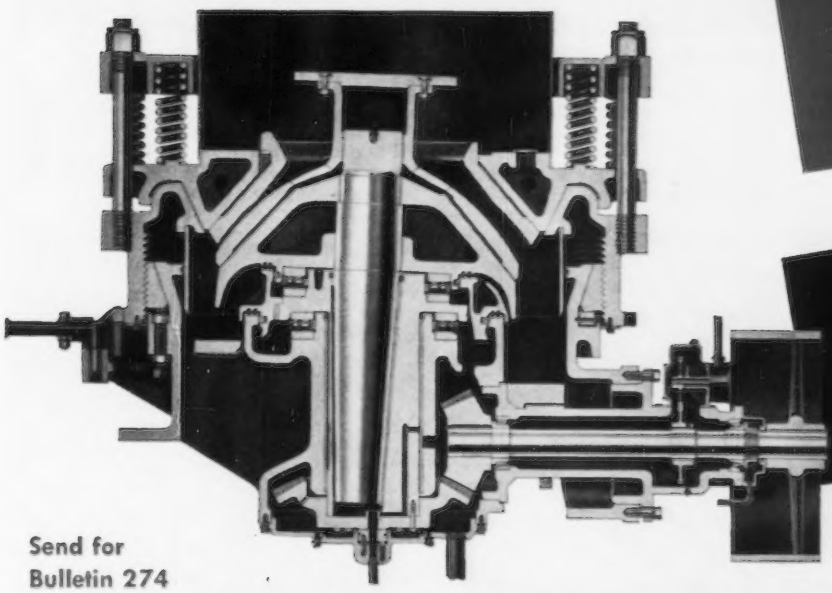
FOR AGGREGATE PLANTS

Proved . . . operating everywhere . . . satisfying all crushing tests! Telsmith Gyraspheres—both Style S and FC—have long stroke, cam-and-lever crushing action, patented rotary seal, large roller thrust bearings, spring relief, easy accessibility—for big capacity, uniform cubical product, and low-cost operation.



STYLE S
for coarse crushing takes choke feed

STYLE S—24 to 66-inch sizes: 3½ to 15-inch feed openings; 10 to 550 tons per hour.



STYLE FC
for fine crushing

STYLE FC—24 to 66-inch sizes: 2½ to 5¾-inch feed openings; 6 to 250 tons per hour.

Send for Bulletin 274

Y-14-R-1

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502 E. CAPITOL DRIVE **MILWAUKEE 1, WISCONSIN**

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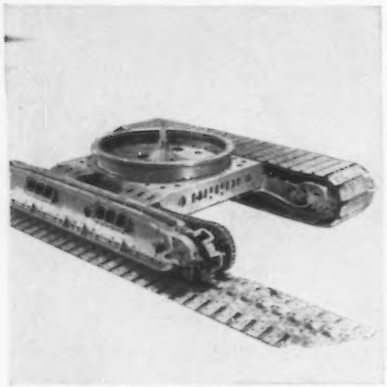

SOLID STABILITY

Look at this massive carbody and these long, wide crawlers! A solid base and a low ground bearing pressure of only 9.6 lbs. per sq. inch let you work right at the edge of a bank.

a quick guide to increased mining output with the Manitowoc 4500

DIRECT POWER FLOW

No one but Manitowoc gives you a slide pinion design that directs power straight to the "business end". Only gears that are working turn and there are only 15 gears in the entire unit!

UNIFIED POWER PACKAGE

The 4500 is diesel engine powered with the capacity to tackle any job. There are no fussy electric motors . . . no dead-weight . . . no delicate circuits.

GREATER MOBILITY

Your operator travels steep grades without "babying" his machine . . . there's no rocking when moving. Lets you mine anywhere! And fast between job moves can be made by rail or highway trailer.

HI-LIFT BOOM

A 60′ Hi-Lift shovel boom and a 45′ stick are available to give extra reach and height. Standard 120′ dragline boom handles 6-yd. bucket . . . special 140′ boom and 4-yd. bucket extends digging range.

CYANAMID

REAGENT NEWS

"ore-dressing ideas you can use"

Three Diverse Examples of Improved Solid-Liquid Separation with AEROFLOC® 550 Reagent

CHEMICAL PRECIPITATE

In this open-circuit operation an inorganic chemical is precipitated as 0.5 to 1.0 micron particles from an aqueous medium in a hydroseparator reactor. Precipitates are subsequently settled in a 325' diameter thickener. Underflow is subject to further processing, overflow goes to waste.

Loss of values to the overflow—particularly evident on cold and windy days—cut production seriously. Addition of 2 lb. per hour of AEROFLOC 550 Reagent to the reactor feed (0.03 lb. AEROFLOC 550 per ton of dry solids in the circuit) now effectively flocculates and settles the precipitate.

COAL WASHERY SLIMES

In this closed-circuit coal preparation plant all wash water from jigs and flotation is deslimed, clarified and reused. Coarse waste is dewatered on screens, slimes are removed in filter presses. Build-up of slimes in the circulating waste water caused premature filter blinding and excessive down-time. Despite the addition of a starch-base flocculant in quantities up to 12 lb/ton of slimes, it was almost impossible to keep the plant operating smoothly at its rated capacity.

Addition of only 0.4 lb. of AEROFLOC 550 per ton of slimes now gives perfect control with greatly increased filtration rates on both flotation concentrates and waste slimes. Additional savings accrue through the handling of a much smaller quantity of flocculant.

NON-METALLIC FLOTATION CONCENTRATE

At this mill a non-metallic mineral concentrate is processed further. Important prior step is concentrate filtration to produce a constant-moisture content, easy-to-handle filter cake for subsequent processing. Lack of adequate surge capacity between filters and subsequent processing equipment imposed a constant and excessive load on the filters with consequent unavoidable variations in quality and quantity of filter cake.

Introduction of AEROFLOC 550 Reagent to the concentrates pump at the rate of 0.10 lb/ton of cleaner concentrates has materially improved filter-cake uniformity, increased filter capacity and eliminated fluctuations in plant through-put.

AEROFLOC 550 Reagent is serving many mills in many ways to solve settling and filtration problems. Perhaps it can help you improve solid-liquid separation operations. Samples for test, and comprehensive technical data are available. Cyanamid Field Engineers will be glad to advise on its most effective use.

AMERICAN CYANAMID COMPANY

EXPLOSIVES AND MINING CHEMICALS DEPARTMENT

CYANAMID INTERNATIONAL—*Mining Chemicals Department*
Cable Address:—Cyanamid, New York

30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

CYANAMID OF CANADA LIMITED
160 Bloor Street East, Toronto 1, Ontario, Canada

CYANAMID DE MEXICO, S.A.
Apartado Postal 283 Mexico 1, D.F., Mexico

CYANAMID OF GREAT BRITAIN LTD.
Bush House, Aldwych, London W. C. 2, England

SOUTH AFRICAN CYANAMID (PTY.) LTD.
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CYANAMID AUSTRALIA PTY. LTD.
"Collins Gate" 377 Little Collins Street Melbourne, Australia

BIG PROJECTS PROVE IT!

Firestones move more yards per hour on every shift!

From the Texas Turnpike to the Niagara Thruway, Firestone Rock Grip Tires with S/F (safety-fortified) Nylon are reducing breakdown losses, cutting tire costs. Tough Firestone cord bodies withstand severest punishment to last longer with less downtime than any other tire! Two great non-directional tread designs adapt these off-the-highway tires to *any* job condition and eliminate excessive spare tire inventories. You get the *flotation and traction* you need in loose earth and wet going. With the same tire you get S/F Nylon's *armored* protection for hauls over splintered shale and blasted rock. Firestone tires resist cuts and slugging impacts like no other tires made. Ask your Firestone Tire Expert about these *tubed* or *tubeless* extra heavy-duty tires. Call him today at your Firestone Dealer or Store.

ROCK GRIP WIDE BASE ROCK GRIP

Firestone

BETTER RUBBER FROM START TO FINISH

Enjoy the Voice of Firestone on ABC television every Monday evening.

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Corrosion, heat, abrasion or vibration, you can reduce them all with *ESCO* Spuncast pipe. Centrifugally cast in a wide variety of *ESCO* alloy steels, heat treated and tested, *ESCO* Spuncast pipe will cut replacement costs in chemical, pulp and paper and petro-chemical plants, or in any other type of installation subject to severe conditions.

Available in special alloys, in sizes to 36″ OD and wall thickness from ¼″ up and in large or small quantities *ESCO* Spuncast Pipe is the greatest corrosion-resistant value your pipe dollars can buy.

Write for free booklet — "How to Cut Costs With ESCO Spuncast"

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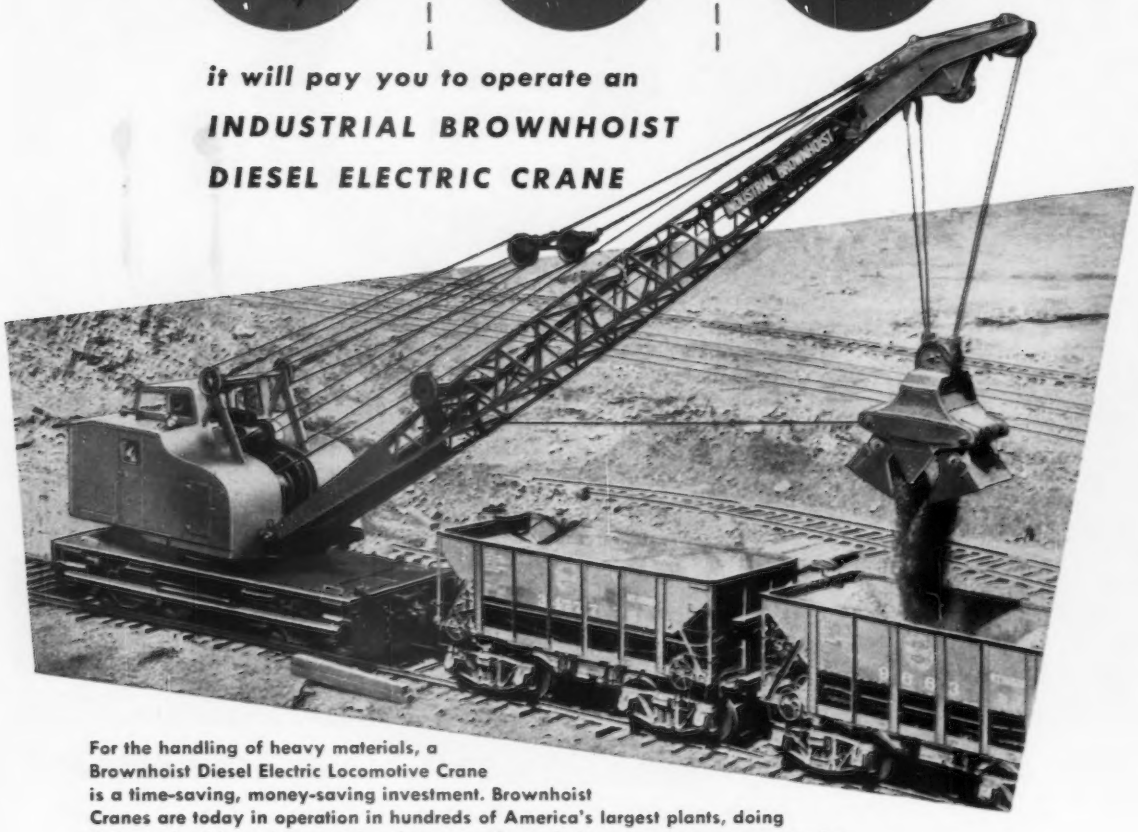
FOR LOW COST HANDLING OF HEAVY MATERIALS IN QUANTITY WITH

magnet | **hook or** | **bucket**

it will pay you to operate an

INDUSTRIAL BROWNHOIST

DIESEL ELECTRIC CRANE



For the handling of heavy materials, a Brownhoist Diesel Electric Locomotive Crane is a time-saving, money-saving investment. Brownhoist Cranes are today in operation in hundreds of America's largest plants, doing their work with a minimum of maintenance. Brownhoist cranes can save money by doubling as switch engines. They haul up to 7 or 8 loaded cars on straight and level track. All Brownhoist machines possess the famous Straight Line Power Train, which means you get the smoothest and most efficient crane operation. Brownhoist cranes give your operator greater visibility through the patented Monitor Type Cab and Clear Vision Boom, allowing him to work faster and with more safety. Electric swing available at extra cost on all models. Industrial Brownhoist Diesel Electric Locomotive Cranes are available in capacities from 25 to 100 tons. Write for Catalog No. 548.

192

BROWNHOIST MATERIALS HANDLING EQUIPMENT GIVES A LIFT TO AMERICAN INDUSTRY

INDUSTRIAL BROWNHOIST CORPORATION
BAY CITY, MICHIGAN • DISTRICT OFFICES: New York, Philadelphia, Cleveland, Chicago, San Francisco, Montreal
AGENCIES: Detroit, Birmingham, Houston

BROWNHOIST

B.F.Goodrich

Why miners choose B.F.Goodrich tires

for the really tough jobs!

THE trucks above haul 20 to 25-ton loads out of a Pennsylvania strip mine. Roads are steep, winding and strewn with jagged pieces of rock. These rugged operating conditions once caused tire blowouts, premature failures and sky-high costs. Then the truck operator switched to the tires you see—B.F.Goodrich Rock Service tires. The report: B.F.Goodrich Rock Service tires "take it" so well they can be *retreaded again and again!*

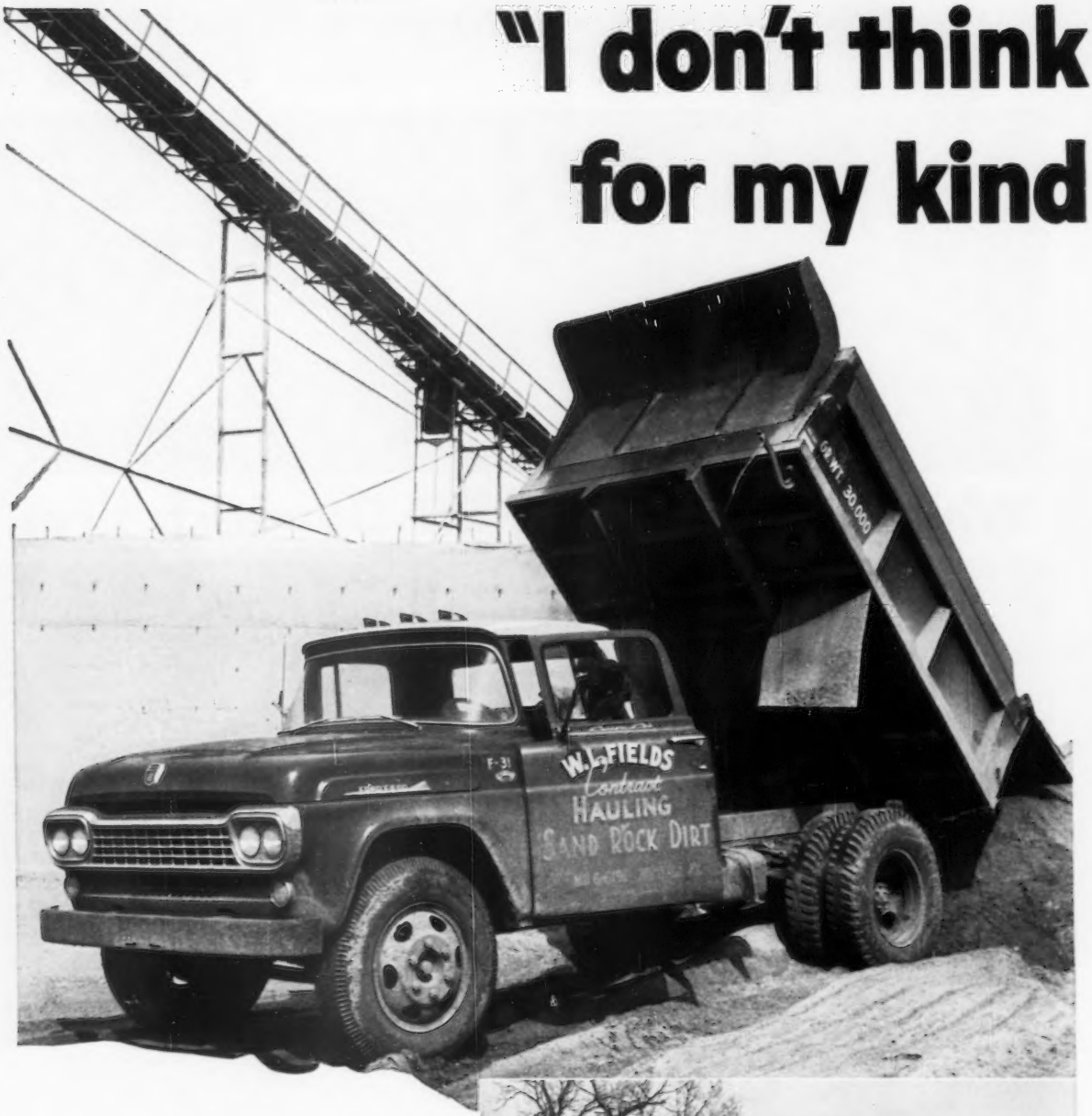
This experience is typical. Miners report longer, trouble-free service and more retreads with B.F.Goodrich Rock Service tires. The B.F.Goodrich FLEX-RITE NYLON cord body withstands double the impact of ordinary cord materials, resists heat blowouts and flex breaks. This Rock Service body outwears even the extra-thick tread, can be retreaded over and over!

Husky Rock Service cleats grip the ground to give positive traction in forward or reverse. Take a tip from miners on the really tough jobs—switch to new B.F.Goodrich Rock Service tires with FLEX-RITE NYLON cord body. See your B.F.Goodrich dealer today—he's listed under Tires in the Yellow Pages of your phone book. *B.F.Goodrich Tire Co., A Division of The B.F.Goodrich Co., Akron 18, Ohio.*

Specify B.F.Goodrich Tubeless or tube-type tires when ordering new equipment

B.F.Goodrich *truck tires*

"I don't think for my kind



Official registrations show . . .

AMERICAN BUSINESS BUYS MORE FORD TRUCKS THAN ANY OTHER MAKE!

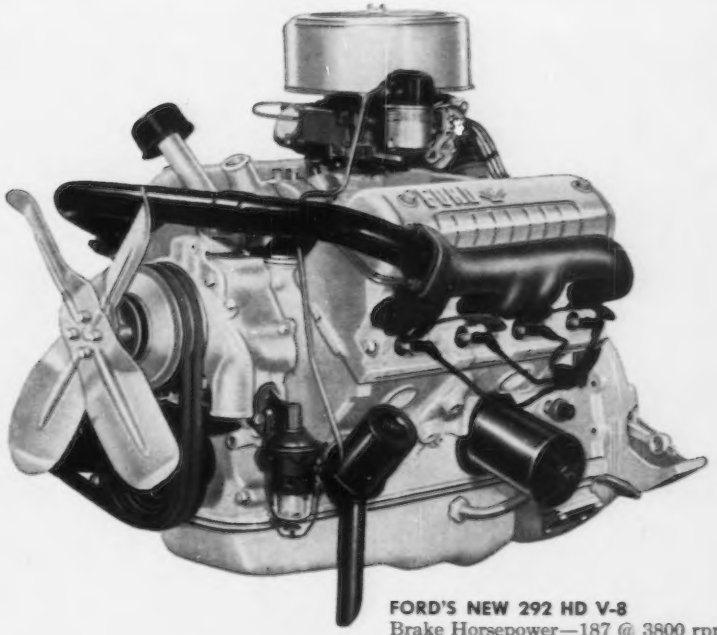
FORD TANDEM with 10-yard dump body and new F-600 with 5-yard dump . . . part of Mr. W. L. Fields's Ford Fleet.

there's a tougher truck of work"

says W. L. Fields
Contract Hauler, Wichita, Kansas

"And they cost less to operate than any trucks we've ever owned!

"Our 13 Fords are mostly two-ton dumps. They haul 6 yards of rock and sand, averaging about 7½ miles per gallon of gas. We get 6 mpg with Ford tandems carrying 14 tons. And they all really hold up. Ford's Heavy Duty V-8's are good for an average of 75,000 miles before an overhaul! We have a '55 Ford with over 150,000 miles on it, and I'll bet there's not another dump truck around here that's in such good shape."



FORD'S NEW 292 HD V-8
Brake Horsepower—187 @ 3800 rpm
Bore—3.75 in. Stroke—3.30 in.
Displacement—292 cu. in.

Whatever your business . . . there's a FORD truck for your special needs

Official registrations for 1957 show that *American business buys more Ford trucks than any other make.* There are many reasons for this popularity . . . many reasons for *you* to make your next truck a Ford!

Ford trucks are your best buy, too! Ford's initial costs are *low* and resale value is traditionally *high.* Modern Ford Styleside pickups, for instance, are the lowest priced with full cab-wide body . . . giving you 23% more loadspace than any traditional type pickup box.

Only Ford offers the economy of Short Stroke power in all engines, Six or V-8. And Ford's Heavy Duty V-8's offer new, advanced durability features. Ford's rugged cab and chassis construction means these new '58s are built to last. All this plus the proven fact that Ford trucks last longer adds up to America's No. 1 truck value.

See your local Ford Dealer for the latest in '58 trucks or the best in A-1 used trucks.

FORD TRUCKS COST LESS

LESS TO OWN . . . LESS TO RUN . . . LAST LONGER, TOO!

6 YARDS

A ten or twelve yard tandem-axle truck loaded in 60 seconds!

***Two* 23-ton semis heaped in three or four minutes!**

***Two* passes for the smaller truck, five for the two bigger ones *combined*.**

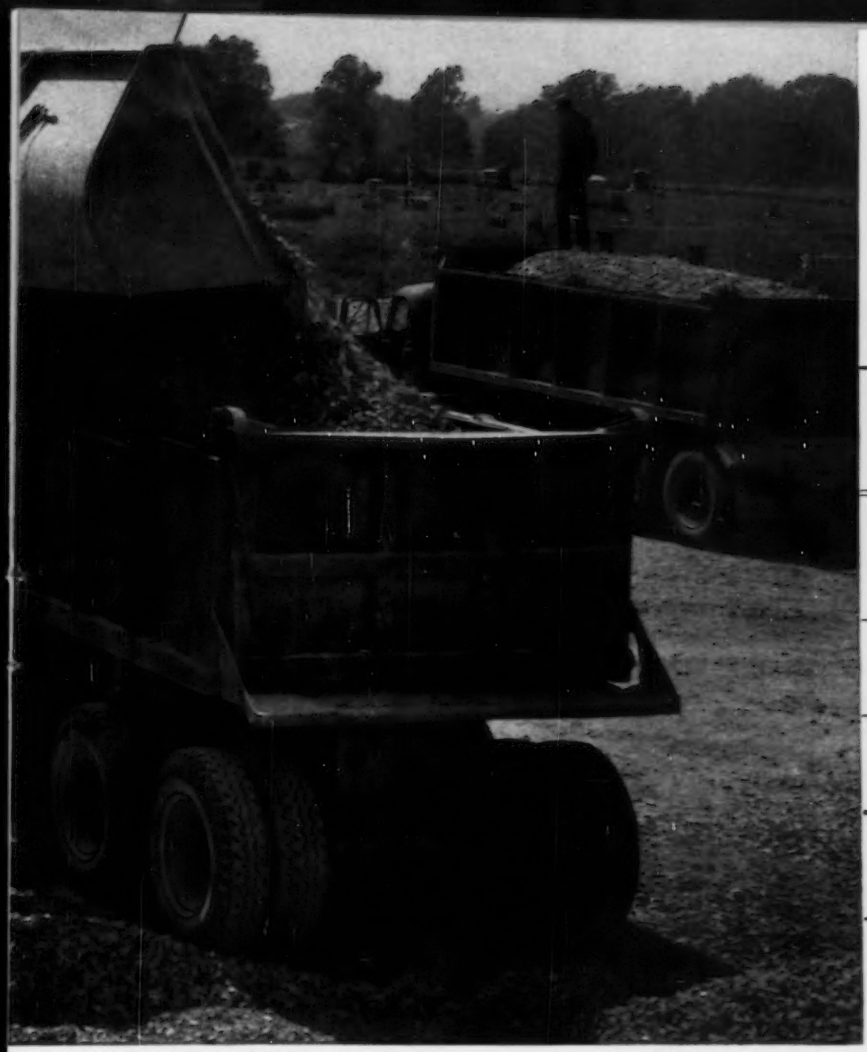
Someone's dream? Not any more! It's been standard practice at Stony Creek Stone Company's pit near Indianapolis ever since last summer. That's when their big *6 yard* Model 375A Michigan Tractor Shovel went to work.

Big production cuts costs, reduces truck waiting time

Stony Creek's problem up until then had been a common one: "How to hold down loading costs, and reduce truck waiting time in the face of rapidly-expanding customer demands." Fast rubber-tired Tractor Shovels had long since replaced cranes and crawler-loaders. The biggest rubber-tired units available, 2¼ yds, were in use. But, production requirements were calling for still more loading capacity. At that point, Company General Manager Dick Irving got a big idea. Visiting the Clark booth at the Road Show, he saw the new 6 yard Model 375A Michigan. "There," he thought, "is a Tractor Shovel that could *really* do a job for us. It could give us enough capacity to replace two smaller Tractor Shovels *plus* handle all the expansion we anticipate for years to come."

Michigan output totals 2,500 tons daily

Today, the big Michigan and its *one* operator do the work of two or more smaller Tractor Shovels. Michigan output averages 2,500 to 3,000 tons of crushed limestone every day. "Despite its size, I'd rather run this big Tractor Shovel than any other," says Operator Carroll White. "It handles easily. It moves and responds just as fast as any smaller loader. Its big low-pressure tires really absorb the bumps. And its smooth ride sure cuts down on the fatigue you'd expect from a 10-hour day—even though I alone load as much stone as two men



Notice how much this big new Michigan *looks* like the smaller Michigans you see everywhere. It handles as easily as they do, too—with power steer, power-shift, torque converter, planetary wheel drive-axles standard. Its entire all-Clark power train is the same design as that job-proved in the 8,000 Michigans now in the field.

Specifications	Model 375A	Model 275A
Bucket capacity (standard SAE ratings)	6 yards	4 yards
Lifting capacity	30,000 lbs.	22,000 lbs.
Weight	61,000 lbs.	45,000 lbs.
Speeds (forward and reverse)	0-25 mph	0-28 mph

PER PASS

did when the pair of 2¼ yard rubber-tired Tractor Shovels were working."

Five passes heap two semis

And that's another reason White prefers the 375A. Higher production! With the smaller machine, White needed at least four minutes and eight passes to load one 23-ton haul truck. With the Model 375A, White regularly loads *two* 23-ton semis in the same time or less—in only 2½ passes each. Two-and-a-half passes? Yes, White does it like this: Two heaped loads go into the truck. On the third load, precise hydraulic controls let White hold bucket so that only half its load is dumped. That fills one truck. The other half-load is fed into the second truck. Then, two more full loads sends this truck on its way too. Thus: five passes, two truck-loads.

Efficiently loads small trucks, too

White even prefers to load a *five-yard truck* with the 6-yard Michigan. Here, the Tractor Shovel bucket is allowed to extend beyond the back end of the truck when dumping. May *sound* wasteful, but before the loaded truck can shift into second, one quick swipe of the Model 375A bucket has cleaned all spillage.

Model 375A easy to maintain

White feels the big Model 375A is as easy to run as *any* Michigan Tractor Shovel—perhaps even a little easier because of its greater weight and better stability. The new Tractor Shovel is easy to take care of, too. In only 10 minutes each morning, White makes his daily maintenance check. Proper care, plus rugged construction, have held repairs to virtually nothing. In the many months Stony Creek has had the Model 375A, there has been *no maintenance at all* on the job-proved Clark power train.

Clark distributors are ready to *show you* this big new dependable 6 yard Michigan, as well as the new almost-as-big 4 yard Model 275A. Call to arrange a date.

Michigan is a registered trade-mark of

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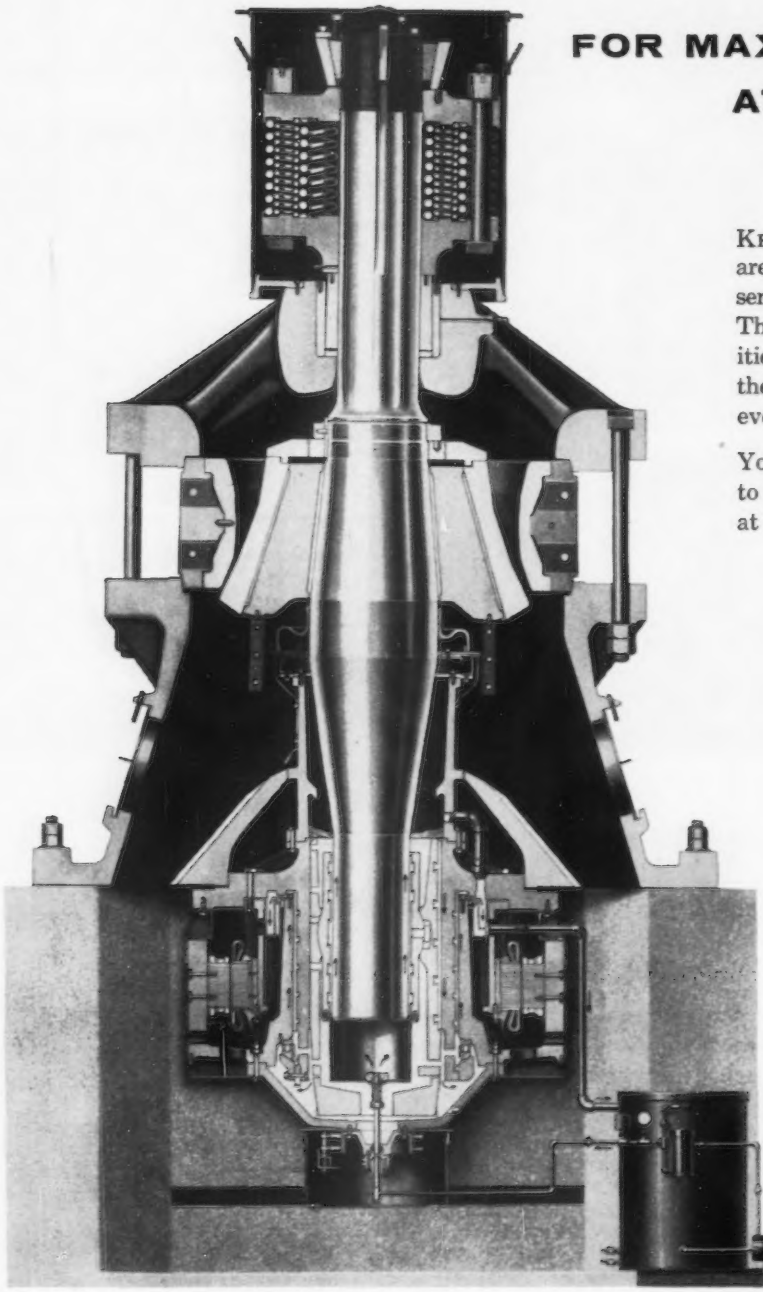

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You can depend on KENNEDY Crushers to handle the maximum rock tonnage at the lowest production cost!

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Synchronous motor built into pulley assembly or V-belt drive

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Power applied ONLY for crushing—no gears to waste power

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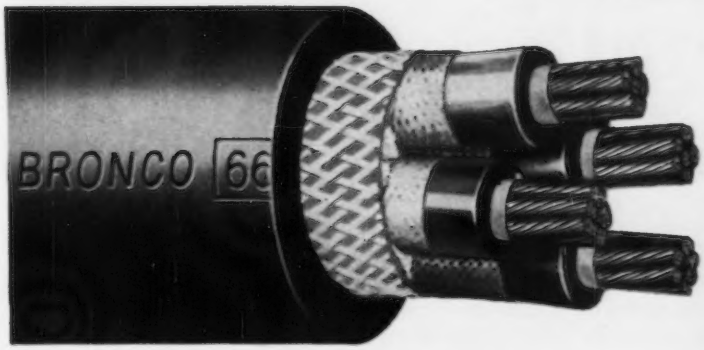

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Bronco 66 Certified Types W, G, and Control Cable are described in detail in the Bronco catalog. Write for free copy.

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Los Angeles 58, California

Graflex Prize-Winning Photo by Josef Scaylea

Battery Users Report "Smoother Sailing" *with* **gould** *batteries*

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It's true! Gould's files bulge with case histories of battery users who have discovered exceptional economy and dependability in Gould Batteries. The reasons are simple: (1) Gould's battery research is the most *thorough* in the world; (2) Gould's manufacturing techniques have been patiently developed for the utmost precision and control; and (3) Gould's large field engineering staff makes routine inspection trips to insure that your batteries are getting the proper care. Want more reasons? . . . write for booklet ". . . so you're going to buy an industrial battery."

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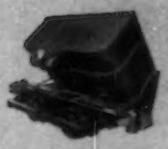

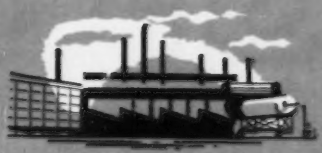

for safety, speed, strength

If your operation involves haulage with locomotives and cars in the 1 to 30-ton range, it will pay you to investigate the advantages of Willison Automatic Couplers.

Willisons are *Safer*—because they couple automatically...*Faster*—because they're self-aligning...*Stronger*—because they take the full buff and pull forces without depending on intermediate parts.

Over 100,000 Willison Automatic Couplers are in daily use in mines, industrial plants and foreign railroad service because they're *safer...faster...stronger.*

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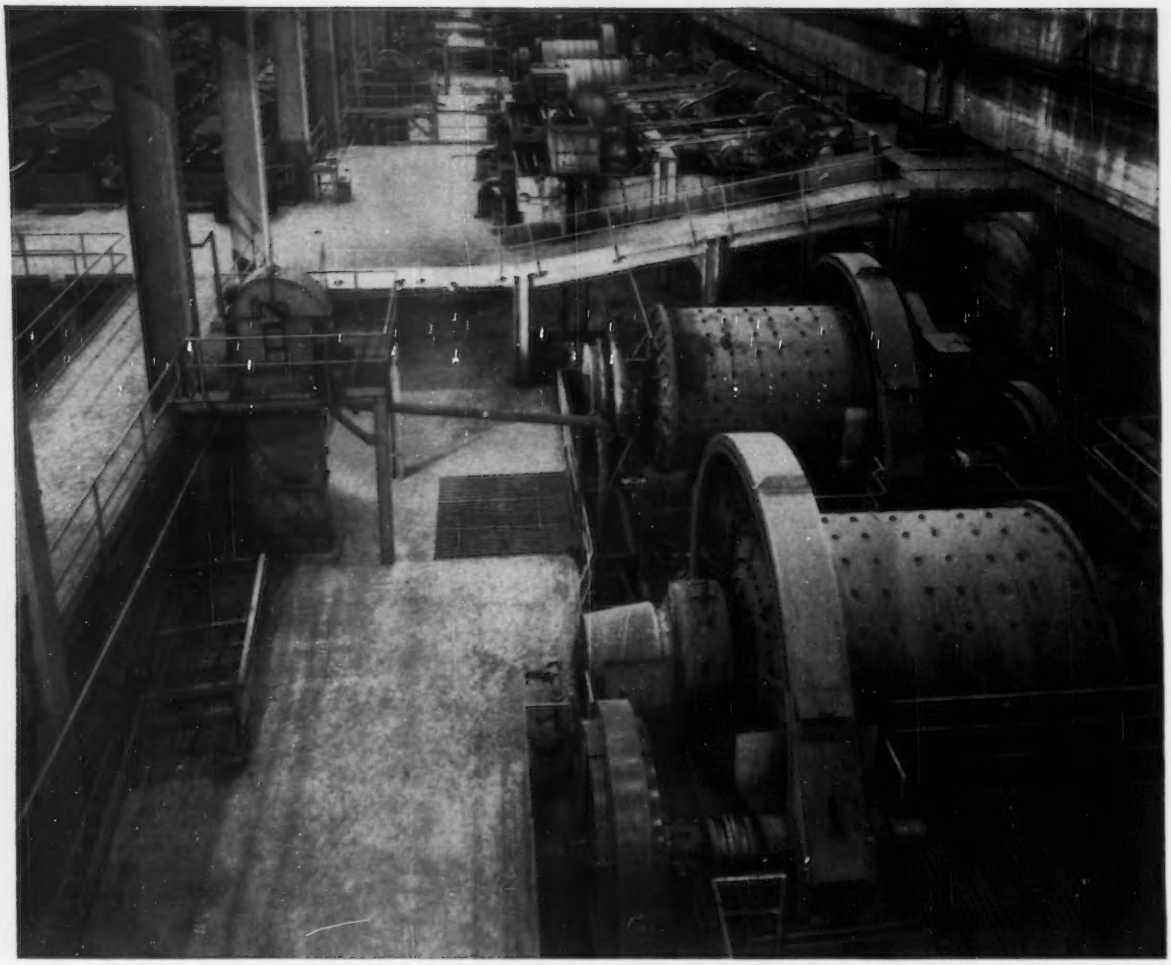

Ni-Hard liners save labor, cut maintenance and grinding costs by providing the utmost in tonnage life. Results obtained in our own grinding aisle show economies you can count on for your own mills.

Ni-Hard shell liners wear only .018 lb. per ton grinding more than 3 million tons of nickel ore

This high tonnage life demonstrates the outstanding performance of Ni-Hard* nickel-chromium white iron shell liners in the concentrator shown above.

Only recently, two sets of lifter bar liners were removed from rod mill service in this plant, Inco's Creighton concentrator, which began operating in 1951.

Used in large mill

The Ni-Hard shell liners served in 10′8″x13′ mills grinding highly abrasive nickel ores with 3″ and 3½″ rods. Mills ran at 60% of critical speed. At the discharge, solids in the slurry ran 70%. Total life in the #1 mill was 3,430,000 tons of ore; in #4 mill, 3,266,000 tons. The liners for each mill originally weighed 60,912 lbs.

This example of Ni-Hard shell liner service is a severe one . . . nickel ores are among the toughest. But the record of Ni-Hard liners in such service shows what this material can do for your grinding operations.

Where your abrasion is severe . . . use Ni-Hard liners.

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The only REVERSIBLE cap and adapter made...

Try this on- for SAVINGS!

Service-proved WEARPACT Cap Type Tooth —with foolproof retainer—cuts digging costs to record lows . . . even in taconite!

Probably by now you've heard of Wearpact Steel—the alloy with a combination of hardness and toughness not available in any other commonly used alloy.

Here's a new tooth and adapter design* cast in longer-wearing Wearpact . . . the ASF Cap Type Tooth and adapter —the *only* such tooth and adapter that's reversible for longer life. Note that the tooth itself is self-sharpening. Keeps on *slicing* through the ore and overburden—and when finally worn, there's less metal to throw away. *The tooth locks securely to the adapter.* No ASF retainer has ever failed in service.

As for service life, the cost-per-ton figures in large mines speak for themselves. Lowest of any tooth on record! Give this dollar-saving tooth a try! Write today to arrange for an installation.

Cut your costs with WEARPACT

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On the roughest SEALTITE electrical

against oil, grease, water, dirt, chemicals, corrosive fumes, salt spray, weather.

SEALTITE is a flexible *and* liquid-tight electrical conduit. It gives maximum protection to your wiring when it must connect moving parts, absorb vibration, follow machine contours, flex into U-bends, be easily maintained or be safeguarded between misaligned outlets.

It is being used successfully in wet locations, in tunnels, power plants, steel mills, canneries, chemical industries and in many outdoor applications. Sealtite comes in three types:

TYPE U.A.— TYPE C.S.A. Specifications for Type U. A. (Underwriters' Laboratories Approved) and Type C. S. A. (Canadian Standards Association Approved). Construction: flexible galvanized steel core, positive ground and tough extruded outer cover.

TRADE SIZE	INSIDE DIAMETER		OUTSIDE DIAMETER		APPR. INSIDE BEND DIAM.	EST. WGT. (Lbs. Per 100 Feet)
(Ins.)	Min.	Max.	Min.	Max.		
⅜	.484	.504	.690	.710	6	30.0
½	.622	.642	.820	.840	7	36.6
¾	.820	.840	1.030	1.050	10	48.2
1	1.041	1.066	1.290	1.315	12	87.7
1¼	1.380	1.410	1.630	1.660	15	116.5

TYPE E. F.† (Extra Flexible)—for machine tools and industrial equipment. (Meets standards set by J.I.C.)

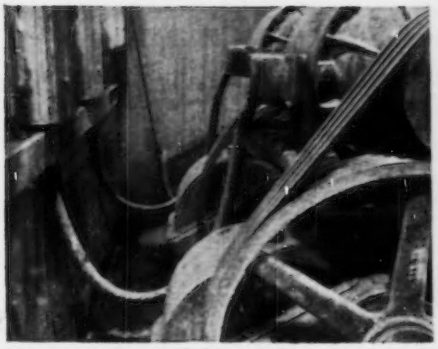
TRADE SIZE	INSIDE DIAMETER		OUTSIDE DIAMETER		APPR. INSIDE BEND DIAM.	EST. WGT. (Lbs. Per 100 Feet)
(Ins.)	Min.	Max.	Min.	Max.		
⅜	.485	.500	.695	.710	5	24
½	.620	.635	.825	.840	5	29
¾	.815	.930	1.035	1.050	6	39
1	1.030	1.050	1.295	1.315	8	67
1¼	1.370	1.390	1.635	1.660	10	87
1½	1.575	1.595	1.875	1.900	12	105
2	2.020	2.040	2.350	2.375	15	135
2½	2.480	2.505	2.850	2.875	20	198
3	3.070	3.100	3.470	3.500	26	282
4	4.000	4.040	4.460	4.500	34	414

Commercial tolerances apply on above figures.

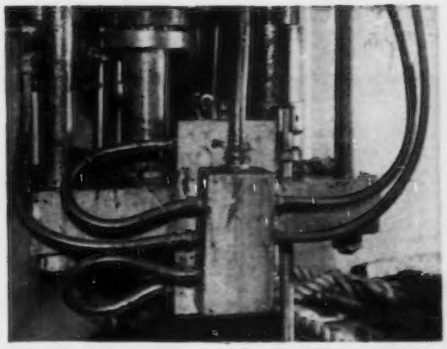
ELECTRICAL WHOLESALERS stock Sealtite. Buy it in long, random lengths on nonreturnable wooden reels, at no extra cost. Available in sturdy cartons that are easier to store and carry to the job. Liquid-tight connectors also are available from wholesalers' stocks. For information write: The American Brass Company, American Metal Hose Division, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

†Pat. applied for SA182

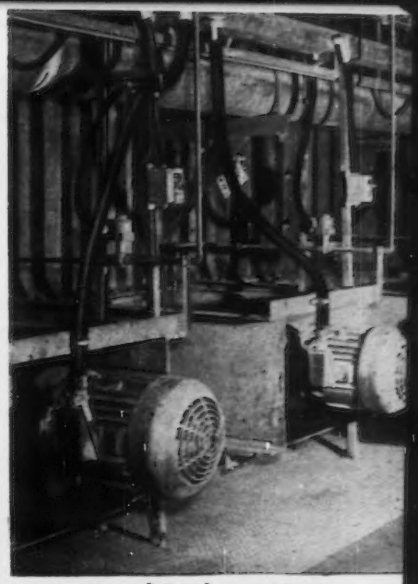
jobs in your plant conduit protects wiring



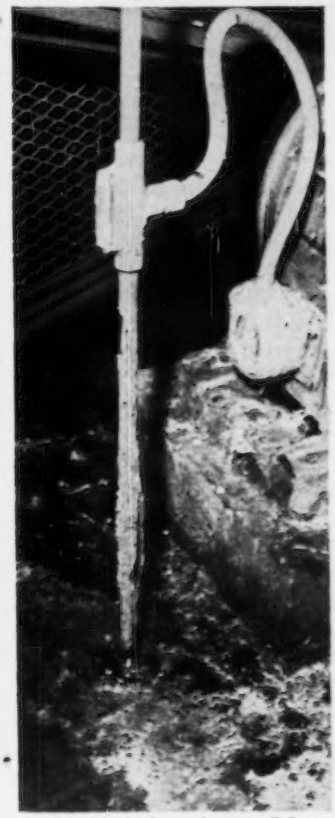
ABRASIVE GRIT around these sand pumps in a rod and ball mill pit can't faze Sealtite.



OIL, GREASE, WATER constantly cover these Sealtite control connections. Still no trouble.



BOILER HEAT and 6-inch expansion rise are easy service for Sealtite.

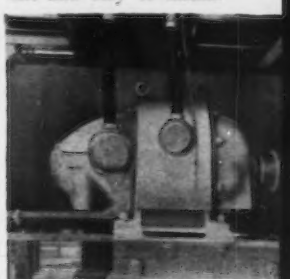


CHEMICALS. Sealtite shrugs off hot chlorine vapors in this plant—another example of its ability to resist chemicals and corrosive fumes.

WEATHER. Install Sealtite outdoors. It stands up under tropical sun and heat, rain, ice, and arctic cold. Protection is complete.

ON MOBILE EQUIPMENT Sealtite can take up movement, withstands weather, dust, vibration. It's fast and easy to install.

MOVEMENT AND VIBRATION that would crack rigid conduit are absorbed by Sealtite on connections for these tailings pumps.



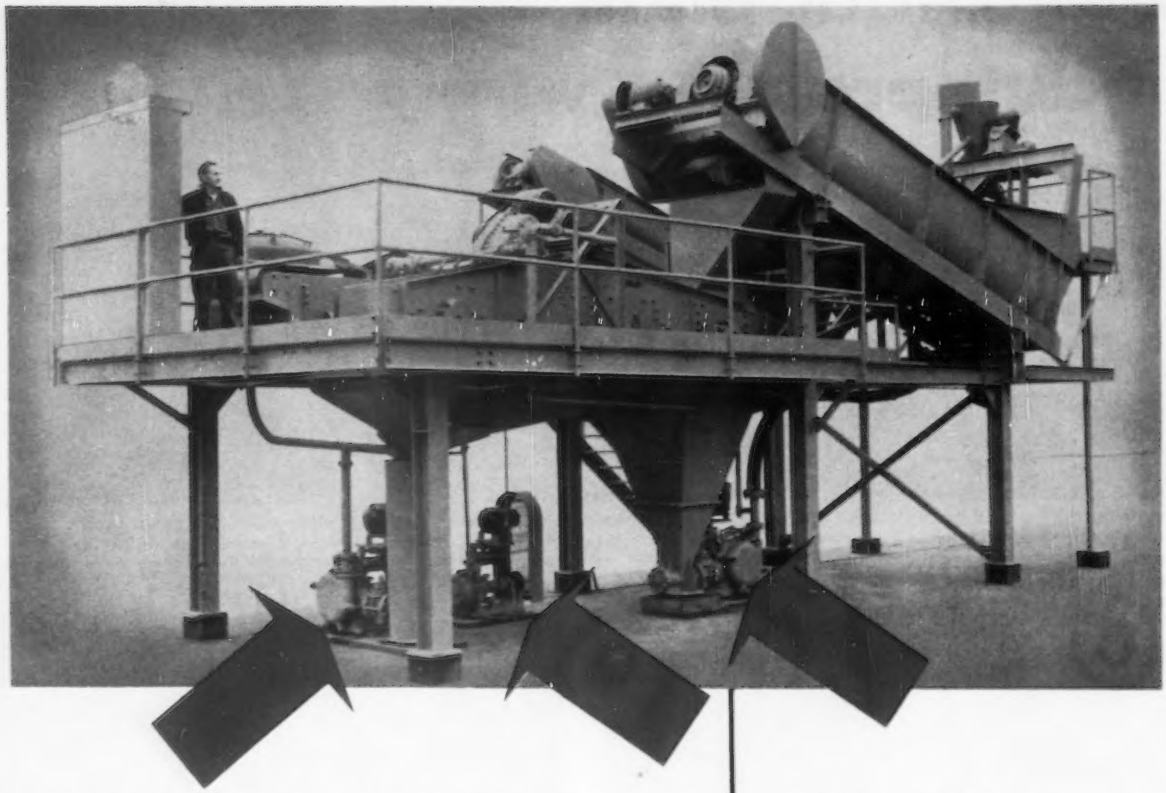
ABRASIVE DIRT AND VIBRATION at this ball mill motor are tough enemies—but Sealtite can take it.

CUTAWAY SECTION of Type U.A. Sealtite shows tough polyvinyl jacket over flexible metal core. Copper conductor wound spirally inside conduit gives positive ground.

Insist on the conduit marked **SEALTITE®**

FLEXIBLE, LIQUID-TIGHT CONDUIT

an **ANACONDA®** *product*



In this Heavy-Media-Separation Plant SWECO relies on WILFLEY SAND PUMPS for low-cost, trouble-free service.

Southwestern Engineering Company's factory-built Heavy-Media-Separation Plants permit the recovery of low grade waste ores... convert them into profitable products. Wilfley Sand Pumps are a vital factor in this operation. Their maintained high efficiency, long pump life, and continuous, maintenance-free performance guarantee lower pumping costs and increased production. Let Wilfley Sand Pumps go to work for you. Available with long-wearing parts of hard alloy or abrasion-resistant rubber.

Write, wire or phone for complete details.

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"COMPANIONS IN ECONOMICAL OPERATION"
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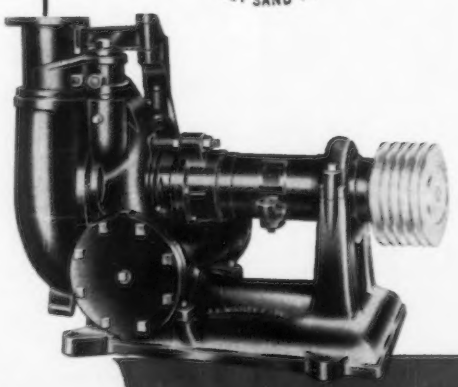

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ENGINEERING AND MINING JOURNAL

MAY 1958

Mining Needs a Climate, Not a Crutch

AT THE APRIL CONVENTION of the Wyoming Mining Association, Gov. Milward L. Simpson told members that Wyoming aims to establish "a proper economic climate for industry to move in." See report p 128. Apparently companies active in the international field of mining regard Wyoming's "economic climate" as attractive—at least two recent announcements would substantiate this:

1. U.S. Steel's Columbia-Geneva Steel division has awarded a preliminary engineering contract for its proposed $16-million taconite ore-processing facility, near Atlantic City, Wyo. See *E&MJ*, April 1958, p 188.

2. Reynolds Mining Corp., subsidiary of Reynolds Metals Co., announced that it has exercised options on 7,300 additional acres in the Lake De-Smet, Wyo., area, including the lake itself. Walter L. Rice, president of Reynolds Mining, said the property adjacent to large coal deposits, "is being acquired as a potential power site for possible future expansion of Reynolds Metals Co.'s aluminum reduction facilities." The coal seam in the Lake De-Smet area is from 150 to 200 ft thick—thickest in the Western Hemisphere.

It is interesting to note that these two projects, although conditional in nature at present, show that two large companies, who have searched the world for future raw materials and power sites, have selected Wyoming as a favorable area. This is particularly significant because Wyoming, remote as it is from the shores and borders of the U.S., is actually in competition with the world. The statement has been made repeatedly that "the blast furnace does not care where its iron ore comes from." The blast furnace will draw on the resources of those states and countries which make it economically feasible for the steel companies to produce low-cost steel for society. Perhaps it is equally true that the alumina derived from bauxite doesn't care where it is smelted, provided that the power at the smelting site is adequate, assured and economical.

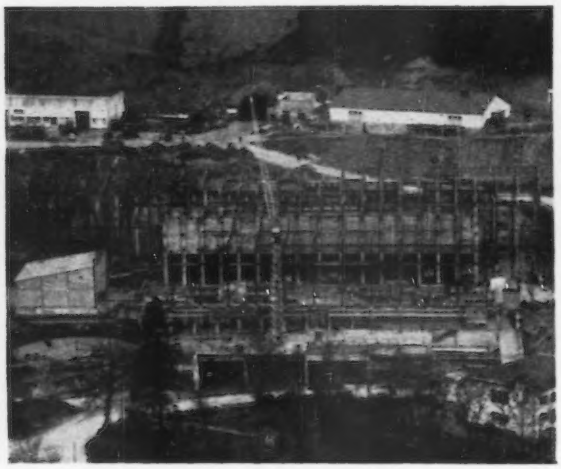
The State of Wyoming and its youthful but rapidly expanding mining industry are to be congratulated for having recognized the importance of a "proper economic climate" for expanding industry.

Two serious deterrents to mining are: (1) The policy of taxing mineral reserves in the ground, and (2) unreasonably high separation or production taxes. Since most ore deposits today are low in grade, the value of the ore does not lie in the ground, but in the work which has to be done on the ore to mine it, process it and transport and market the refined product. Hence, the chief value of an orebody lies in the livelihood that mining and mineral processing afford to citizens of a state, and in the collateral transportation and supply business that is required to maintain the mine.

Failure to recognize this basic economic principle has cost a number of states some huge mining enterprises, and is in no small measure responsible for the fact that U.S. investors have decided to favor mining ventures in certain provinces of Canada where mining is encouraged, not penalized.

Finally, now that many states are clamoring to the U.S. Government for help to shore up a flagging mining industry, it might be a good time for all states to re-examine tax laws and other policies to see if everything possible has been done to establish "a proper economic climate for industry" on a local level. Most assuredly these states can help themselves. Anything the Federal Government might do might be temporary and undependable.—Ask the tungsten miners; and the copper, lead and zinc producers who depended upon Government stockpiling.

Admittedly, overproduction and excess imports of certain metals are responsible for some of the distress in domestic mining states. This merely underscores the fact that the mines of the U.S. are in competition with those of the world. To some extent this situation can be relieved by tariffs. But it would be regrettable indeed if resort to Government aid and protection weakened the domestic industry to the point that it could no longer muster up the ingenuity and vigor to stand up to this competition. It is distinctly unreasonable for certain states, for instance, to discourage and tax mining out of their borders, and then turn around and ask Uncle Sam to encourage mining with special aid and protection.



ST. PATRICK'S drive-in copper mine at Avoca (behind boom) has a 4,000-tpd concentrator presently under construction.

12-TON TRUCK MOVES UP the main tunnel to the entrance. Mine management plans to macadamize the 3200-ft "highway."

Ireland Prepares for A Renaissance in Mining

WILLIAM COUGHLIN

LARGE-SCALE PRODUCTION of copper and pyrite concentrates is to start in July at the "drive-in" copper mine of St. Patrick's Copper Mines Ltd., a subsidiary of Mogul Mining Corp. of Toronto, Canada.

First shipment of concentrates from this unusual mine will be a major step forward in the government-supported resurgence of mining in Ireland. There is no commercial copper production at present.

There aren't very many copper mines where you can arrive at the working face, 360 ft underground, in a Mercedes-Benz. But at St. Patrick's, a 17x17-ft main tunnel has been driven to a length of 3,200 ft, with plans calling for ultimate extension to 6,000 ft and a depth of some 700 ft. The tunnel makes a hairpin turn at the 2,500-ft mark to slant back across the lower footwall of the lode.

Floor of the main tunnels is being macadamized as a roadway capable of handling 34-ton haulers which can be loaded at the faces. It is one of the early applications of the "drive-in" mining technique to vertical lodes.

Objective is to make possible a highly-mechanized operation, bringing the costs as near as possible to those of open-pit mining. "In fact, what we're trying to approach is open pit work underground," V. B. Bjorkman, assistant to the managing director, says. Managing director H. D. Foreman says initial investment and operating costs are expected to be somewhat lower than those of more conventional shaft mines.

The mine will not hit full stride until completion in mid-year of the firm's concentrator, capable of handling 4,000 tpd of raw ore. At the moment, more than 100,000 tons of ore are awaiting concentration, stockpiled from the 400 to 500 tpd of ore and waste coming out of the mine from development tunneling.

A 30-tpd plant on the site has been operating for some time for metallurgical testing and production of pyrite samples, as well as training of operators.

Original ore is running slightly more than 1% copper although pockets of 7- to 8% have been encountered in the tunneling. Production is expected to yield about 160 tpd of 25% copper concentrate, together with 500 tons of pyrite concentrates, which it is hoped will be a large income-producer.

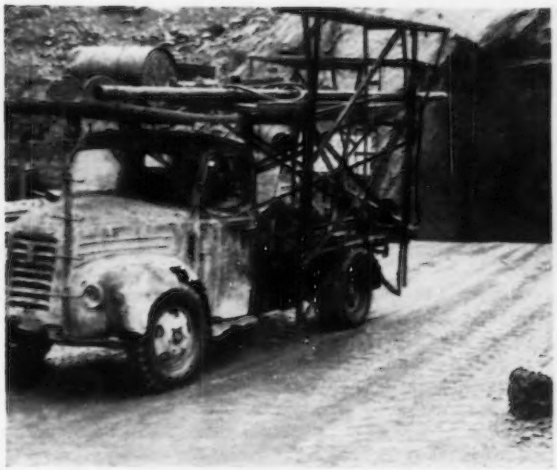
British chemical firms now import considerable quantities of pyrite from Spain and Canada. St. Patrick's will have a competitive freight advantage of up to $4.20 a ton on this. Copper concentrate will be shipped to the Continent for smelting.

NEW PRODUCTION is coming from the old mines along Ireland's coastline.

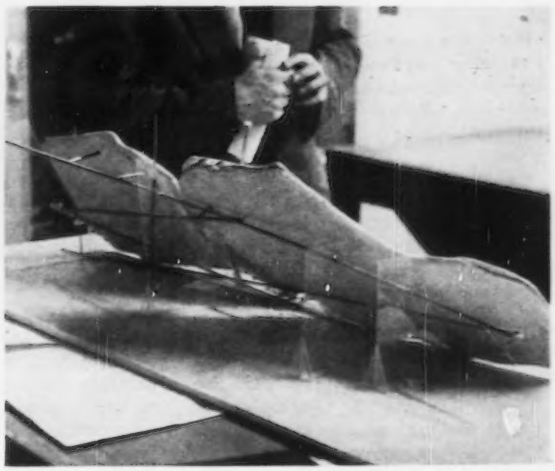
Nearly a quarter of a million dollars has been spent on dredging and improvements at the small port of Arklow, seven miles from the St. Patrick's mine, which is located in the historic and lovely "Vale of Avoca," County Wicklow. Of this amount, the Irish government and local port authorities have provided $84,000 and St. Patrick's the remainder. Ireland's state-owned trucking industry will haul the concentrates to the port.

Erection of an Irish smelter has been discussed but officials at the Department for Industry and Commerce say no decision has been made. It is doubtful whether the output of St. Patrick's alone would justify it. It is believed start of production by

Mr. Coughlin is chief of the McGraw-Hill London news bureau. His article is based on visits to the Irish copper mines and interviews with government officials of Eire.



THIS IS THE "TOAST RACK." Improvised initially for installing ventilation piping, it now serves the roofing crews.



MINE COPPER LODES at the West Avoca deposit show 45 deg dip. "We're trying to approach open pit work underground."

DELUXE TRANSPORT at Avoca. Visitors rode auto right to the working face.

M. V. O'BRIEN is director of Ireland's Geological Survey, works out of Dublin.

Emerald Isle Mining Co. at Allihies might add sufficient volume to make it worthwhile, however.

"We would prefer to see private enterprise provide the smelter with our encouragement, rather than the government itself doing the job," a government official said.

There are considered to be two main orebodies at St. Patrick's West Avoca workings, the South lode and Pond lode, although these in fact result from different types of mineralization rather than separate bodies. There also is a North lode, which contains mostly pyrites and very little copper.

Tunneling has indicated that 75% of the ore lies in the central area, which caused St. Patrick's to hairpin its tunnel at 2,500 ft rather than to go in further as initially planned.

The lodes lie on a dip of about 45 deg with a width of from 80 to 140 ft. The abandoned mines at Avoca, dating back to 1812, took out 6 to 8 ft of a high grade streak on the footwall side of the lodes. The new mine is coming in behind them and using the old workings to blast into the lode. Ring drilling is employed with some longhole drilling up to 90 ft. About 20 faces now are being worked.

One unusual piece of equipment in use is a U.S. Caterpillar with a Swedish LIBU shovel mounted on it. This shovel can tip sideways as the loader moves alongside the hauler in the tunnel, enabling faster work in the close confines at the face. Euclid S-7 12-ton haulers have been used extensively in the development tunneling.

St. Patrick's large tunnels permit use of an ingenious two-level drilling platform mounted on a Caterpillar, with four men drilling on the top level, four on the bottom. Another useful piece of equipment has been a mobile hydraulic platform controlled from its own cage, manufactured by Simon of England.

Water is being pumped at a rate of 300 gpm from the present mine into the old workings and then evacuated from there.

Some open-pit work will be done at West Avoca. An 1875 cave-in exposed part of the main rib, from which the firm estimates about 160,000 tons of ore can be taken. At East Avoca, on the opposite bank of the river which flows through the small valley, it is estimated there may be several million tons of open-pit work. Diamond drilling in the old mine there has indicated the ore may be somewhat richer than West Avoca.

St. Patrick's total concession in the area, leased from the government, is close to 20 square miles. On the eight acres to which it has surface rights, it is putting up the concentrator, repair shops, mine building, administration building, and housing.

To build its own labor force, St. Patricks' is operating a two-week training school for miners. This includes classroom work in the mornings, practical work in the mine in the afternoons. The course is followed by an assignment to a pool gang for a month or longer before final assignment in the mine. Mine officials say one problem resulting from the long period of inactivity in Irish mining has been development of experienced shift bosses.

The staff and work force at the mine is entirely Irish, with the exception of three Canadians in super-

visory positions: managing director Foreman, assistant to the managing director Bjorkman, and mill superintendent Ross Cory. The mine superintendent, A. J. M. Clesham, is Irish.

Total payroll at the mine at the moment is 422, including the construction gang on the concentrator, with 145 men working underground.

When St. Patrick's began tunneling in March 1956, copper prices were over $1,120 per ton. In March 1958, they were in the neighborhood of $448 per ton. The price drop brought reports in the Irish press that production plans at St. Patrick's were being shelved, which the company has denied. Costing of the operation was not based on copper remaining at $1,120. But officials hope the price will climb at least to $672 a ton. Good prospect of pyrite sales has been a factor in continuing development despite the depressed copper market.

In the 1956-57 period, European use of copper increased some 15.2% The 1957 increase alone was 208,382 tons. St. Patrick's is well situated to meet this demand. The company has put some $5.6-million into the mine and arrangements now are being completed for a state-guaranteed loan of an additional $3.6-million.

The Canadians entered the picture after more than $1.4-million was spent in initial explorations by a government-financed company called Minerals Ltd., which proved 12-million tons of raw ore at Avoca, one of the largest deposits in Europe. The Avoca deposits first were mined in the Napoleonic era but were abandoned in 1875. The large low-grade reserves have been worked only sporadically since then.

Completion of St. Patrick's selective flotation concentrator will be a major event in the revival of Irish mining. Despite a slowdown caused by falling commodity prices, the renewed interest in Irish copper and lead deposits is continuing, supported by government-guaranteed loans and tax exemptions.

Three major copper areas contributed to somewhat substantial Irish production in the last century: Avoca, Allihies and Bunmahon. Allihies, for example, produced ores containing about 20,000 tons of copper, a reasonable output in terms of that period. In addition, substantial lead deposits on the island also were worked in the period between 1820 and 1870.

Mining virtually ceased in Ireland after that, not from exhaustion of reserves but due to the lack of technical and financial resources to deal with the problems encountered. At its peak, production of both copper and lead had reached about 1,500 tons of metal contained in concentrates as shipped.

M. V. O'Brien, director of the Geological Survey of Ireland, believes the current revival marks a return to normal on the development curve rather than representing an abnormal condition.

Development at Allihies, County Cork, is being undertaken by the Emerald Isle Mining Co., a subsidiary of Can-Erin Mining Corp. of Toronto. Deposits there are straightforward readily-treated copper ore without by-products. Bulk samples taken from two underground zones showed 5.6% and 6.05% copper and the main shaft of the old Mountain Mine now has been taken to 1,800 ft in ore said to be "extremely rich." The company's geologist says it is not unreasonable to expect 1-million tons of ore from the area.

Emerald Isle's major problem is to get the lower part of the old workings, which involves considerable dewatering. The firm says progress on this is excellent.

The third major copper area, at Bunmahon, County Waterford, has been proved by Explorers Alliance of Toronto through a subsidiary called Bunmahon Copper Mines Ltd. But within the past year, the group has suspended work "pending a study of results." This decision came after copper prices began falling sharply.

Copper has been the most prominent feature in the Irish mining revival. But considerable interest also has been shown in lead, particularly at Abbeytown on the shores of Sligo Bay, where Johannesburg Consolidated Investments has been in production since 1950. Including some production in County Tipperary and County Wicklow, over-all Irish lead production has totaled about 2,000 tons a year of lead contained in ores with a like amount of zinc.

Although an American firm has recently taken out a prospecting license for barytes in County Cork, exploratory interest has been largely Canadian and largely aimed at copper, lead and zinc, of which numerous minor deposits are known in Ireland.

Moderate amounts of molybdenite have been found in County Galway but, according to O'Brien, the grade is not such as to justify mining or quarrying under present market conditions. Small deposits of antimony, with a persistent content, have been found in County Monaghan and there has been intermittent panning of gold near Avoca, but with little success.

Ireland produces only about one-tenth of its coal requirement, averaging about 180,000 tons a year. But in 1957, this rose to 248,000 and O'Brien feels there is no reason this should not be sustained or improved. With the aid of U. S. counterpart funds, the de Valera government is planning to spend some $224,000 on further exploration of Leinster coal.

Political climate in Ireland at present is favorable for foreign investment. In addition to considerable tax concessions, the government is prepared to assist with loan guarantees.

"There is no difficulty in admitting foreign firms for mineral development," officials at the Department for Industry and Commerce say. "We're quite anxious to get people to come along, look for minerals, and help develop them."

Tax concessions granted to mines in Ireland include the following:

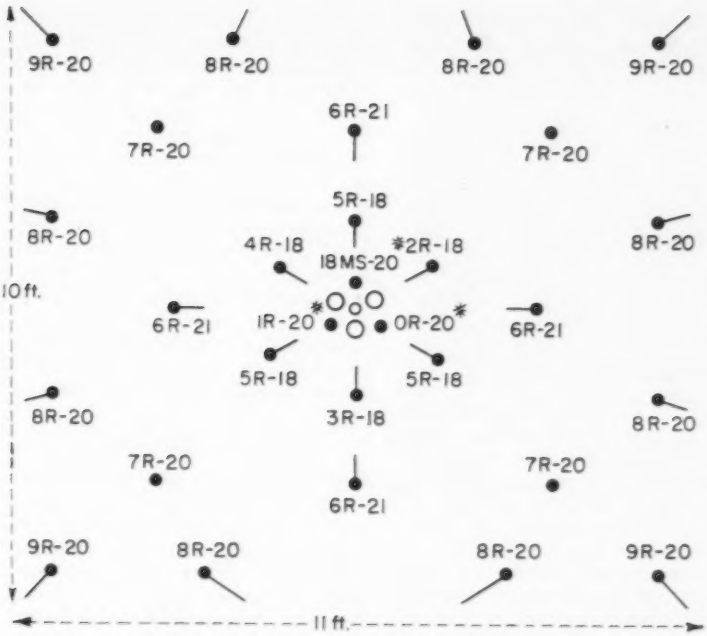
1. Allowances may be claimed against the profits of a mine in respect of capital sum spent in the development of the mine, on search for or testing deposits or winning access thereto or on the construction of certain works. The allowances are spread over the estimated life of the deposit or over 20 years, whichever is the shorter period.

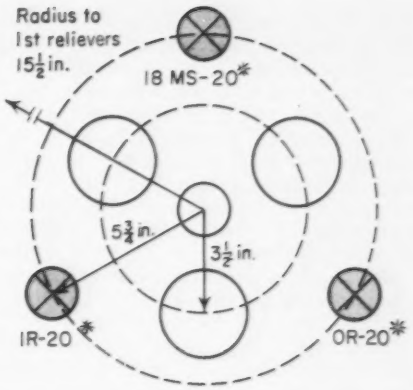
2. Profits to resident Irish companies—that is, companies incorporated, managed and controlled in the state—from new mines of certain minerals are exempt from tax for the first four years and are liable to only one-half tax for the next four years, from the commencement of production in commercial quantities. To qualify under present regulations, the mine must come into production within the five years which commenced April 6, 1956.

The minerals qualifying are barytes, feldspar, serpentinous marble, quartz rock, soapstone, and ores of copper, gold, iron, lead, manganese, molybdenum, silver, sulphur and zinc.

The requirements for Irish control of the firm may be waived by special license. There also is provision for importation of mining machinery free of tariff.

Ownership of Irish mineral rights depends on ancient land acts which have resulted in a mosaic of about 70% government and 30% private ownership. In cases where extensive and assorted private holdings would complicate the assigning of mineral rights, the government has the power to exercise compulsory acquisition at a fair value.





Drilling Data: Three 3 in. and four 1⅝ in. cut holes, plus 26-1⅜ in. holes; all 12 ft deep.

Blasting Data: Unblackened holes empty; "6R-18" indicates No. 6 Regular delay detonator with 18- 1x8-in. sticks of Gelamite No. 2 (Hercules 40%, velocity 11,500 fps); "18MS" indicates No. 18 (450 ms) DuPont millisecond delay detonator; "*" indicates explosive is DuPont Lump Coal CC (vel. 5,500 fps) in 1¼x8-in. sticks tamped lightly.

RECENT result of mining research at St. Joseph Lead Co. is this drift round which pulls 11 ft.

How St. Joe Uses Mining Research

JOHN J. REED
RICHARD L. BULLOCK
JOSEPH J. YANCIK

MINING RESEARCH is not new with St. Joseph Lead Co. Back as far as World War I, the search began for an efficient mechanical loader. By 1925 this resulted in the St. Joe shovel[1] —so successful a design that about 50 of these machines, acquired during the next few years, are still in regular efficient service after 30 years. Much has been done on drill and bit testing, and on developing drill rounds for column mounted machines and for jumbos.[2] Shaft sinking has been highly developed in southeast Missouri, both as to efficiency and safety[3]. And it was here that roof bolting was born, some 15 to 20 years before its rapid growth in coal fields.[4]

Department Setup in 1955

Essentially this testing and development was on a practical basis; and, although much of it had been successful in the past, it was decided in 1955 that solving many of the future problems would need a more fundamental approach. On that basis a new mine research department was organized.

Projects under investigation by the present mine research department can be divided into two general classifications. One group of problems lends itself to relatively rapid, independent solutions. The other group requires long range fundamental studies and the relatively long term solution of many complicated and interrelated problems.

Drifting Efficiency Is Studied

The first assignment—an example of the first classification—was development of an improved drifting cycle. The present drift crew consists of two men on contract who use air feed drills mounted on columns. Their cycle of clean, drill, and blast is completed every shift, and average advance in a 10x12 ft drift is 5 to 6 ft per shift, using a pyramid cut. Many attempts have been made in past years to develop a successful burn or shatter-type cut for Lead Belt dolomite, which would permit breaking a deeper drift round. No consistent success was ever achieved because the broken rock always "froze" or recompacted in the cut, and the rest of the round could not break. It was apparent then, that although drilling, loading, and haulage would probably all need improvement before a long drift round could become a reality, the single truly critical requirement was a consistently successful deep cut.

Eighteen months of research, testing and development led to a three-large-hole shatter-cut drift round. It was considered acceptable after it was tried 25 times, drilled 12 ft deep, and averaged 11 ft of advance.[5] An attempt to apply a somewhat shortened version of this round using jack-legs led to the development of a simple drilling jig, which aided the accurate drilling of the cut pattern. It was finally concluded, however, that there was too much drilling for two men with jack-legs in this size and depth of round, and a jumbo unit was the only logical answer.

Now, after another year of development, a two-man drift jumbo has been built with three booms and machines capable of drilling the shatter-cut round 8 to 10 ft deep in about 2½ hours. With bigger drills and longer feeds, the same rig should drill 10 to 12 ft in the same time.

Other Projects Aid Drifting

When fundamental investigation of the cut had progressed to the point

Dr. Reed is head mine research engineer and Messrs. Bullock and Yancik are mine research engineers for St. Joseph Lead Co., Bonne Terre, Missouri.

where ultimate success was assured, three projects of a more applied nature were initiated to solve related problems of a greatly improved drifting cycle. One is development of a drifting jumbo mentioned above. Ultimate goal of this project is a diesel powered unit mounting 3-in. machines on 12-ft feeds, and preferably adapted to drilling in both drifts and production stopes.

Second related project was the test of ten standard percussion rock drills with different combinations of steel and bits. This resulted in tabulated ratings as to efficiency and penetration rates. The work emphasized importance of hole size, air pressure and consumption, and steel size and length. It provides a valuable ready reference from which to choose best combination of drill, steel and bit to meet a given set of conditions.

Third related project is an investigation of rotary-percussion drilling. This system of drilling holds great promise for the future in that it should provide faster, more efficient drilling with greatly improved steel life in our medium-hard, non-abrasive dolomite.

Pillar Recovery Is Tackled

Second major assignment of St. Joseph Lead Co.'s mine research department is one which requires long-range fundamental studies—developing way to recover pillars in old mines and to increase extraction in new mines. It is estimated that 10-15% of original ore has been left as pillars since mining began in 1864. This now represents an attractive ore reserve, but its recovery is complicated by towns and company plants over much of the mined area.

One project in attacking the problem is a series of case history studies. Regular periodic observations and measurements are made on several large caved areas in the mines. Similar investigations are made in active stopes to study degree and progress of convergence during mining.

Another fundamental project concerns suitable instrumentation for rock mechanics studies. This has involved design and development or use of a convergence extensometer, roof bolt compression pads, a 20-in. Whittemore strain gage, microseismic equipment, borehole load cells, Valore gages, and sonic velocity determinations. At present, a project is being set up to study physical properties of various rock zones in an effort to correlate roof behavior in different mines with the type of roof rock in each case. Instrument development is a major problem in the general field of rock mechanics, because very little suitable equipment is available "off the shelf", and almost every item must be hand made to fit the particular application.

Knowledge and experience gained from case history studies, and developing usable instruments, has led to a first attempt at pillar recovery. Plan being followed involves greatly improved roof bolting techniques and application of systematic rather than casual bolting. By systematic bolting on 4 and 5-ft centers, spans up to 100 ft have been held under normally bad roof conditions, while pillars were blasted and the ore loaded. Convergence measurements and micro-seismic records have been the principal means of assuring safety during these operations. While this plan of pillar recovery has very definite limitations, there are many areas where it can be applied, and its costs appear competitive with those of mining new ore. It is hoped that continued studies will lead to methods for complete removal of pillars over large areas, perhaps with delayed tailings fill to prevent excessive surface subsidence.

Over the past 20 years, a considerable number of massive concrete pillars up to 12 ft in diameter and 50 ft tall have been built in the Lead Belt mines. Most of these were built to safeguard important installations, but some were supposed to replace rich ore pillars which were then to be removed. In order for a pillar of this size to carry a load approaching its safe capacity it must be shortened on the order of ¼ in. Under normal conditions this can only happen if the roof comes down by that amount, and experience and observation indicate that before this happens the roof usually breaks up and falls around the pillars without ever causing failure in the pillars themselves.

In an effort to improve this situation studies are being made to develop a system of pre-loading large pillars to a relatively high proportion of their ultimate capacity. In addition to preventing further deformation of the roof this system should actually tend to reduce the already existing strain in the roof and adjacent pillars. Application of flat jacks injected with grout is being studied as a possible solution.

Grouting Is Being Systematized

Grouting itself is another research subject. It has always been of some importance in southeast Missouri mining because the ground is cut by many fractures and solution channels. However, it has never become a continuous part of operations, and therefore experienced crews are always scattered and lost between jobs. Thus there has been very little accumulation of experience and data on a continuing basis. Studies are being made to improve this situation. All available literature on grouting is searched and digested. This is supplemented by laboratory tests and case studies of grouting jobs in the mines. It is hoped that this will result in a sort of operating handbook on grouting to help new crews and in selection of suitable grouting materials and equipment to meet varying conditions of each application.

To Encourage Others

It is hoped that this brief outline of the St. Joseph Lead Co.'s mine research program will prove of interest to others in the mining industry and will stimulate the development of similar efforts elsewhere. There is an urgent need to raise mining from the level of an art towards that of a science. A greatly expanded effort on fundamental and applied research plus a more active interchange of ideas between organizations and branches of engineering should do much to meet this challenge.

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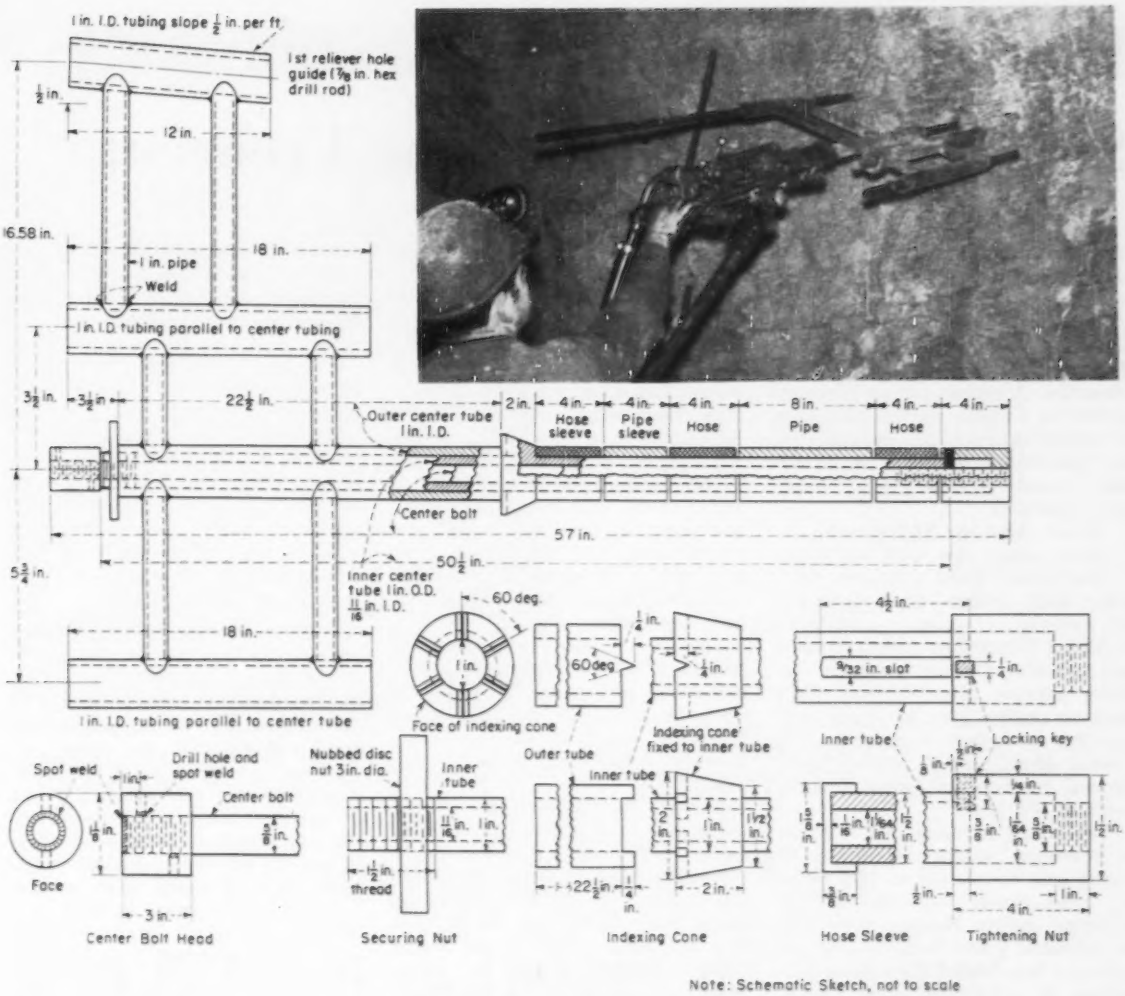


Note: Schematic Sketch, not to scale

RIGID FRAME of pipe is built on outer center tube. When securing nut is loose, frame can rotate about inner center tube; but when nut is tight, teeth on outer center tube fit in notches on indexing cone and prevent rotation. Inner tube is held secure in hole by expansion of rubber hose sections, effected by turning center bolt and drawing up tightening nut.

St. Joe Jig Aids Airleg Drilling of Long Cut

SIMPLE HOLE-LAYOUT JIG was devised for airleg drilling of deep "shatter" (burn) cut at St. Joseph Lead Co., Bonne Terre, Mo. Mine research group—Dr. John J. Reed, head; Richard L. Bullock and Joseph J. Yancik, engineers—developed both jig and cut. (Drawing is shown on title page 85.)

Jig is designed to insure correct hole spacing and alignment which are especially critical for efficient long-hole shatter cuts. It is only used for drilling the 30 to 40-in. starter holes. Starter steel is 5-ft, ⅞-in. hex for conical-taper slip-on bit.

To use jig, first step is to drill a 1¾-in. center hole. It should be 36-40 in. deep and as straight as possible. When completed it is washed clean. If any cut holes are to be reamed to larger size later on, this first hole should be angled up slightly to aid flushing of cuttings from the holes.

Second step is to emplace assembled jig. "Stinger" (i.e., long projection which bears short sections of hose) is inserted into center hole up to "indexing cone." Outer hole-guide is oriented to hang vertically below center hole. Then by hammering on head of "center bolt," indexing cone is wedged tightly into collar of drillhole.

Third step is to anchor jig more securely. Head of center bolt is turned with 18 or 24-in. pipe wrench to draw-up "tightening nut" and thereby expand rubber hose sections into tight contact with hole sides. During drilling it may be necessary to retighten occasionally.

Drilling now begins. In this first position, all three hole-guides are used. On completion of the three starter holes, "nubbed wheel" on inner center tube is loosened and guide frame rotated 60 deg so indexing points on outer center tube fit into next pair of vee-slots in indexing cone. Nubbed wheel is tightened and outer hole only is drilled. Frame is rotated another 60 deg for three holes, etc. until entire cut is drilled to starter depth. Jig is then removed by loosening center bolt and withdrawing stinger.

At St. Joe, three large relief holes are completed next. These are first drilled at least 4 in. deeper than final depth (e.g., 12 ft plus 4 in.) with standard bit, after which they are reamed to full size. (e.g., 3 in.) Remainder of starter holes are then extended to full depth. Standard practice of eye-aligning drill using drill steel in adjacent holes is followed. As it is, the first 30-40 in. drilled with jig keeps holes aligned fairly well.

How the Canadians Successfully Stop Townsite Water Pipe Freeze-up

COST VERSUS RELIABILITY is a formidable conflict in planning residential water supply systems in cold climate. Maintenance and ground conditions, including rock outcrop and permafrost, as well as air temperature, are obstacles. A recent comparative cost survey in Canada permits evaluation of several schemes. Survey was made by Underwood McLellan & Associates, consulting engineers of Winnipeg, Manitoba.

Above about the 55th parallel, the common single pipe with 8-ft burial is insufficient. Frost ordinarily penetrates much deeper—depth depending on severity of winter—and more elaborate precautions against freezing are necessary. Deeper burial, one obvious solution, often involves costly rock excavation; even 8-ft burial runs into this in northern Canada. Besides, even at depth, permafrost often keeps ground temperature below freezing most of the year.

The report indicates that if burial is economic, simplest precaution is continuous circulation in the mains by using closed loops through the pumping station. Heating alone may be economic where fuel costs are low and can be a useful supplement elsewhere. In permafrost areas and/or where rock excavation are obstacles, a system with piping in above-ground, insulation-filled boxing is the answer. Finally, a two-pipe layout right to the houses may be necessary to insure complete circulation in extreme cold conditions.

Buried single-pipe installations with provision for heating are recommended for natural gas and crude oil centers south of the Precambrian rock such as at Fort St. John, B.C. and Leduc, Alta. Further north where rock outcrop and permafrost begin to be a problem, the economic answer probably is limited burial aided by continuous circulation of heated water in a partial two-pipe layout, as at Uranium City, Sask. But where rock outcrop is common, above-surface installations of boxed mains and house connections are cheaper and more satisfactory in terms of maintenance and service, for example, the mining town of Flin Flon, Man. Permafrost conditions likewise make an above-surface scheme most economical and trouble-free, as at Aklavik on the delta of the Mackenzie river north of the Arctic circle.

At Fort St. John and at Leduc an abundance of cheap natural gas made heating of the entire incoming 34-deg F water supply feasible, according to N. A. Lawrence, president of Associate Engineering Services Ltd. of Edmonton.

During the winter of 1955-56, 30% of all connections in the town of Leduc froze up, he reported. This was partly because the asbestos cement mains, although buried 8 ft, happened to be on streets with little snow cover and so suffered from deep frost penetration.

The consulting engineer in this case profited from the experience of the nearby city of Edmonton, which uses waste heat from an adjacent steam generating station to heat most of its domestic water supply during the winter.

Raising the temperature of the water to 44 deg F has proven sufficient. This is done as the water enters the treatment plant so as to improve the efficiency of the chemicals used (alum, lime, and carbon). An 800,000 Btu per hour gas-fired hot water boiler is used to furnish hot water which is circulated by a centrifugal pump through two 1-in. copper coils which are installed beside the low lift pump in the wet well. As there is a time lag in the passage of water through the wet well, flocculator and settling basin, accurate control of temperature is not essential. The results appear to be satisfactory. In the month of deepest frost penetration, April, water temperature in the system has not gone below 38 deg F. Chemical feed has been reduced 25%, and the cost of the natural gas is about $92 per month.

Uranium City (pop. 6,200), near the 60 deg parallel, is only five years old. Test holes indicate that adequate cover throughout the system could involve costly rock excavation. In addition, ground temperatures remain below freezing at depth for most of the year.

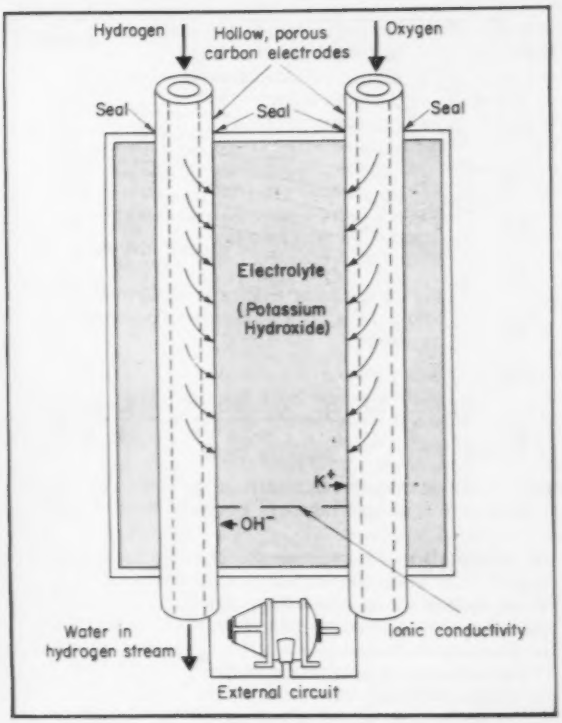
Since this is the only modern townsite for permanent residents within a 16,000-square mile block of country, it is believed essential to encourage residential growth by holding utilities cost as low as possible. It has been decided to adopt a single supply main system which forms closed loops at the heating-circulating station and has single-pipe house connections. The system is to be buried 9 ft where practicable but less where rock is encountered. Provision for heating the water as well as circulating was incorporated in the design. Two-pipe layout to fire hydrants insures circulation to these essential points. Construction of the water system is estimated to cost $377,000 as compared with $484,000 estimated for a two-pipe system.

Flin Flon (pop. 15,000) employs a two-pipe continuous circulating heated-water system involving above-surface boxed mains and house connections. During winter the heated water makes a complete circuit through supply mains and house connections and back out other house connections and return mains. Boxes are made of wood and the enclosed pipes are insulated with wood shavings except in the occasional subdivision where deep burial is feasible.

System was installed in 1951 at a cost of $1,750,000 and at present serves 2,700 premises. It includes 21 miles of supply main in 10, 8, 6 and 4-in. sizes and 17½ miles of return main in 6, 4, 3 and 2-in. sizes. Average daily water consumption is 440,000 gal in summer and 540,000 gal in winter due to bleeding to sewers to prevent sewer freeze-up. Recirculation, proven to be the most important factor in preventing freezing, reaches a maximum rate of 1,100 gpm, and average fuel consumption through a winter is 60,000 gal of Bunker C oil. To provide operating flexibility, there are two stations containing steam boilers, heat exchangers and recirculating pumps. Water costs now average $4 a month per dwelling and there is no sewer service charge.

In Aklavik, on the 68 deg parallel, the opportunity to install a utilidor system came with a decision to move the townsite. Construction was under way last summer. Here a cost study established that it was by far the cheapest. The above-ground insulated box contains sewer and water pipes, central heating system, power supply and telephone lines. Entire box is kept at a temperature to prevent freezing rather than heating the water supply.

HYDROGEN AND OXYGEN combine to form water and energy to power the lights in this National Carbon fuel cell.



ELEMENTS OF NEW FUEL CELL consist of two hollow, porous carbon electrodes in an electrolyte bath.

A New Battery—the Fuel Cell
Will It Have an Impact on Mining?

AMONG THE SCIENTIFIC MARVELS to be exhibited at the Brussels World's Fair will be a fuel cell developed by National Carbon Co., Division of Union Carbide Co. Since this cell is repeatedly referred to as a battery, and in many respects functions as a battery, its importance as a portable energy source is worth the careful appraisal of lead producers, and also mineral processing plants which use dc to extract metals by electrolytic methods.

How the Cell Works

As shown in the accompanying illustration, the new fuel cell consists of two specially treated porous carbon tubular electrodes passing through an electrolyte solution. Hydrogen and oxygen enter through the hollow electrodes, and diffuse through the porous carbon to the surface, where they come in contact with the electrolyte. At the hydrogen electrode the electrochemical reaction with the potassium hydroxide produces water and releases an electron that enters the electrical circuit. The electron flows through the external circuit, and returns to the cell at the oxygen electrode, where the electron is accepted. Ionic conductivity through the electrolyte completes the electrical circuit.

Thus science has taken one long stride closer to the long-sought goal of producing electricity directly from fuel, without the intermediary resort to conversion to steam to power turbo-generator sets.

Over-all efficiency of a steam system is approximately 30 to 35%, whereas the fuel cell which eliminates the intermediate heat step, and converts directly from chemical to electrical energy, has a top efficiency of about twice that figure.

Fig. 1 shows the operating voltage of the cell as a function of gas pressure, for various values of electrode current density. The same data are redrawn in Fig. 2 to show the direct influence of changes in current density upon operating voltage. The nature of electrode reactions limits the maximum conversion of fuel energy values into electrical energy to a value slightly over 80%. But for a fuel cell operating at practical values of current density, 75 to 70% conversion efficiency is easily attained.

A convenient approximation of electrochemical efficiency is expressed in this formula:

$$\text{Per cent efficiency} = \frac{\text{voltage}}{1.2} \times 100$$

Thus a fuel cell operating at 0.84 v is $\frac{0.84}{1.2} \times 100$, or 70% efficient.

National Carbon Co. reports that the fuel cell could be operated on air as well as oxygen. Present optimized design objectives for fuel cells operating on air at atmospheric pressure is 0.25 kw per cu ft and three watts per lb. The company's objective for fuel cells operating on pure oxygen and with the entire system pressurized to 5 atmospheres in 1 to 1.5 kw per

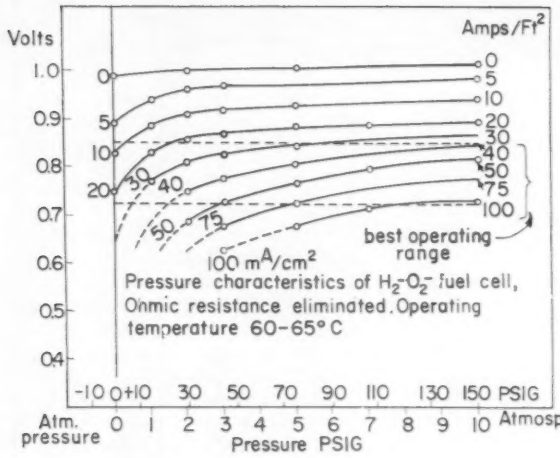


FIG. 1. OPERATING VOLTAGE of the cell varies with gas pressure for various values of electrode current density.

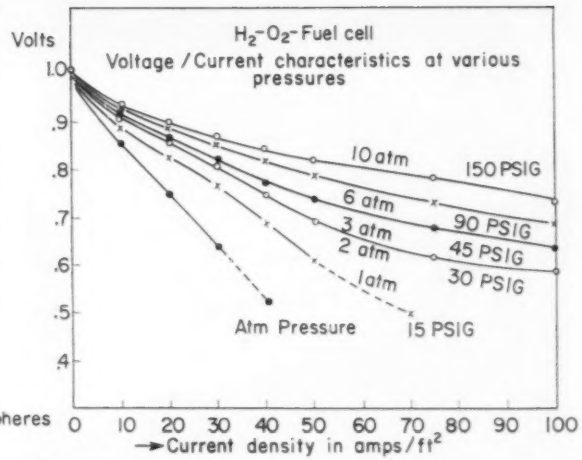


FIG. 2. SAME DATA shown in Fig. 1 is redrawn here to show how current density changes affect operating voltage of cell.

cu ft, and 10 to 15 watts per lb. The larger sizes give the better output. These figures are for the battery complete but do not include fuel supply or pressurized pumps.

For example, a pressurized battery to produce 90 amp at 11.2 v would weigh 65 lb, and occupy a volume of ⅔ cubic ft. Fuel supply is additional.

Sources of Hydrogen

Operation of the fuel cell requires a source of hydrogen. In portable batteries where hydrogen generating equipment must be light, metal hydrides are an excellent fuel. In larger installations, hydrogen can be obtained from catalytic cracking of various compounds such as ammonia, hydrocarbons or other organic materials. For some proposed applications of the fuel cell, hydrogen is already available as a byproduct material. The accompanying table lists several hydrogen sources.

Advantages of the Cell

The cell is referred to as a battery because unit cells can be operated in series to achieve fairly high voltages. A mobile radar set capable of spotting a single enemy soldier at a half-mile away in total darkness is powered by a battery of fuel cells operating at 28 v. U.S. Army Signal Corp. demonstrated this "Silent Sentry" last September. The fuel cell was selected because it fills a great need for a quiet, mobile economical source of power.

The amount of electrical current produced by the cell depends on its physical size. Thus by varying the number and size of cells, many combinations of voltages and currents can be obtained. Basically the fuel cell is most desirable for high current, low voltage uses.

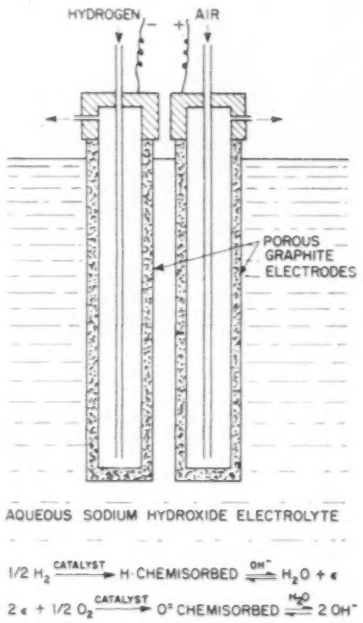

HYDROGEN
AIR
POROUS GRAPHITE ELECTRODES
AQUEOUS SODIUM HYDROXIDE ELECTROLYTE
1/2 H₂ CATALYST H·CHEMISORBED OH⁻ H₂O + ε
2 ε + 1/2 O₂ CATALYST O² CHEMISORBED H₂O 2 OH⁻

FIG 3. FUEL-GAS CELL produces current from reactions of air and hydrogen.

Unlike other batteries, the fuel cell does not wear out. If oxygen and hydrogen are supplied, the unit continues to produce energy.

Where It Can Be Used

Dr. C. E. Larson, research vice president of National Carbon Co., says "The demand for portable and remote silent sources of power has increased rapidly in the last few years, and countless uses await a practical solution to the problem. The fuel cell holds great promise for the future, and the day may well come when such common devices as lawnmowers, outboard motors, and even small cars

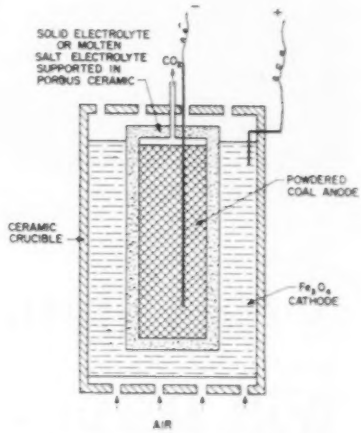


FIG. 4. IN DIRECT FUEL CELL carbon anode is consumed to make power.

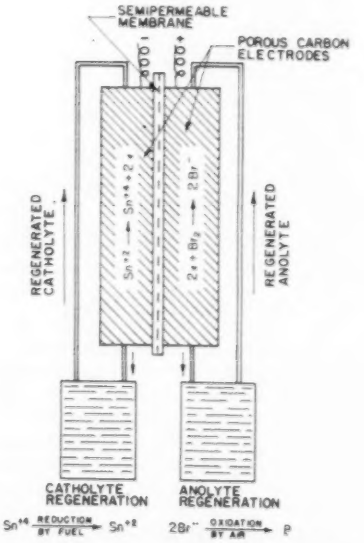


FIG. 5. REDOX CELL makes indirect use of the fuel as a reducing agent.

Sources of Hydrogen

Material	Watt hours per pound	Cost per pound	Cost per kwh
LiH	1800 (1)	$11.00	$6.10
CaH_2	680 (1)	2.20	3.25
Al-NaOH	160 (1)	0.35	2.20
CH_3OH	2000	0.13 (4)	0.05
NH_3	800 (2)	—	0.05 (5)
			0.11 (6)
Cylinder H_2	59 (3)	—	0.81

(1) Does not include water necessary for decomposition. (2) Includes steel tank for 150 lb cylinder size. (3) Includes steel tank for 200 cubic ft size. (4) $0.10 for CH_3OH + $0.03 for fuel oil to heat cracking unit. (5) In tank cars. (6) In 150 lb cylinders.

will be propelled silently by the power output of fuel cells. Gone will be the noisy put-put of the combustion engine, for fuel cells will be using the same fuel to convert directly to electrical energy for powering quiet motors."

Another possible future use of the fuel cell is in connection with both solar and nuclear energy. One of the problems in harnessing energy of the sun is in the storage of power. During sunny periods, the energy of the sun could be used to decompose water into hydrogen and oxygen, for later use in fuel cells. Nuclear energy is known to decompose water, and in present nuclear plants in which the reactor serves only as a source of heat in the conventional steam cycle, efforts have been made to prevent this decomposition. Perhaps it will work the other way, with nuclear energy directly producing hydrogen and oxygen for fuel cell operation.

Three types of fuel cells were illustrated and described in a recent article "Fuel Cell—Potential Source of Electrical Energy" by George J. Young and Ralph B. Rozelle, in the January 1958 issue of *Mineral Industries*, published by Pennsylvania State University. These are illustrated, and mentioned in brief as follows:

1. Fuel Gas Cell. (See Fig. 3) In this unit the gases, hydrogen and air, diffuse into porous graphite electrodes which are impregnated with catalysts. The gases react on the surface of the catalysts with the electrolyte according to the reactions shown. Graphite serves as a conductor for the electrons flowing in the circuit.

2. Direct Fuel Cell. (See Fig. 4) In this type of cell, the carbon in the anode is consumed and converted to CO_2. During the reaction the two atoms of oxygen give up four electrons. Chief disadvantage of this cell is that it must be operated at about 1,000 deg C to be reasonably productive, hence it is considered unattractive for commercial application.

3. Redox Fuel Cell. (See Fig. 5) In this cell, the fuel is used as a reducing agent. The electrolyte solutions, which are separated by a membrane impermeable to the active ions, contain ions that undergo oxidation and reduction in the cell. The electrolyte solutions are regenerated by using carbonaceous fuels for reduction and air for oxidation. Authors of the fuel cell article point out that while there are no thermo-dynamic restrictions on the efficiency of this type of cell, in practice, the regeneration of the electrolyte solutions offer many difficulties. Various metal ions in addition to the stannic ion, used in the cell illustrated, can be reduced by coal in acid solution by autoclaving at moderate temperatures (about 200 deg C).

In evaluating the three types of fuel cells discussed, the authors conclude with the following: "Of the three general types of fuel cells described, the fuel gas cell appears to be most suited for present commercial development. For this reason, much of the current research has been conducted on cells of this type. Basic problems in developing a practical fuel gas cell are: (1) to achieve potentials approaching the theoretical potential of the cell reactions, (2) to obtain high rates of reaction to give suitable current densities at low temperatures, and (3) to design electrodes to give a high ratio of current density per unit cell volume. The main approach to these problems is through improvement in electrode catalysts and surface characteristics, and in proper design of the electrodes themselves."

Catalysts which will improve performance of the air-hydrogen fuel cell are palladium impregnated on the hydrogen electrode, and silver-silver oxide on the oxygen electrode.

NEW BOOKS

ASME Handbook—Metals Engineering Processes, edited by Roger W. Bolz, editor of *Automation*. Covers, in 45 sections, the processes used to heat, cast, hot and cold work the metals, welding, powder metallurgy, machining, and electroforming. Published by McGraw-Hill Book Co., 330 West 42 St., New York 36, N. Y. Illustrated in 448pp. Price $13.50.

Management For Engineers, by Roger C. Heimer. Covers the professional engineer, his duties, ethics; the legal forms of business organization; money flow, profits, cost, time, interest, insurance, light and power examined. Depreciation, inventory, standards, labor, equipment, budgets and other phases of management are also covered. While a little vague in spots, the book will provide the young engineer with an insight into some of the problems he can expect to encounter as he moves into management. Published by McGraw-Hill Book Co., 330 West 42 St., New York 36, N. Y. 446pp. Price $6.75.

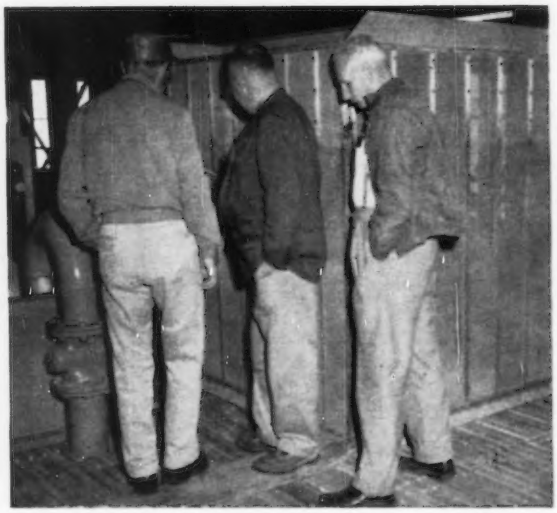
Metalliferous Mine Surveying, by F. Winiberg. 4th edition. Discusses the theodolite, triangulation, field astronomy, traversing, levelling, underground surveying and mathematics. Published by Mining Publications, Ltd., Salisbury House, London EC 2, England. Illustrated in 391pp. Price unlisted.

Minerals Yearbook—1954, Vol. 1, Metals and Minerals (except fuels). Annual publication by the U.S. Bureau of Mines. May be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D. C. 1400 pp. Price $4.50.

Nickel and Its Alloys, by J. G. Thompson. This is the National Bureau of Standards Circular No. 592. Occurrence, refining and metallurgical applications are covered. Also contains a review of literature through 1956. Can be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D. C. 87pp. Price 60c, foreign remittance must be in U.S. exchange and should include an additional 20c to cover mailing.

Mineral Commodities of California, prepared under the direction of Olaf P. Jenkins and edited by Lauren A. Wright. Much like the U.S. Bureau of *Mines Mineral Facts and Problems*, but pertains only to commodities and mines within the state of California. Well done, thorough, with plenty of maps and flowsheets. Published by State Division of Mines, Ferry Bldg., San Francisco, Calif., 712pp. Price $7.50.

VITRO'S decision to convert to solvent extraction was explained to Uranium Institute members by M. T. Ellis on a tour of Vitro Uranium's Salt Lake City mill late in October 1956.



RESIN-IN-PULP is the other dominant process. Edmund C. Bitzer, consultant on the Western Nuclear mill, also helped on the Uranium Reduction mill whose baskets are shown here.

Solvent Extraction and Resin-In-Pulp—Favorites on the Colorado Plateau

SOLVENT EXTRACTION and resin-in-pulp ion exchange are the current favorite uranium recovery methods on the Colorado Plateau. Both methods claim the advantage of being able to treat a wide variety of ores and of having a high throughput potential. Late last August, Western Nuclear Corp. put the Slick Rock, Wyo. resin-in-pulp mill onstream. Recently Vitro Uranium Co., subsidiary of Vitro Corp. of America, completed the conversion from phosphate precipitation recovery to solvent extraction.

Completion of the $1.2-million solvent extraction circuit at Vitro's Salt Lake City mill enables the company to meet new competitive conditions occasioned by the lower concentrate prices now established by the AEC.

Solvent extraction replaced the phosphate recovery method which Vitro continued to use while the changeover was taking place. For a full description of the old flowsheet, see *E&MJ*, September 1955, p 100.

SOLVENT EXTRACTION offers cost savings with lower reagent costs, good recovery, and is flexible in treating a variety of uranium ores at Vitro's Salt Lake mill.

Vitro Relies on

VITRO URANIUM CO.'s Salt Lake City plant relies extensively on automation, without which solvent extraction is virtually impossible. Automation also enables Vitro, a division of Vitro Corp. of America, to reduce the size of its work force—compared to that required in the former phosphate precipitation method.

In addition to the 600-tpd solvent extraction unit, Vitro also has constructed a $400,000 sampling plant of modern design which replaces the custom sampling formerly done at Murray.

The Salt Lake plant has largely been rebuilt since 1951 when Vitro converted a wartime alumina plant to an

The new method will save money, says president W. B. Hall, because reagents are less costly, the process lends itself to automation, and it has a better recovery record. Another advantage is that solvent extraction is more flexible in treating a variety of uranium ores.

Mr. Hall believes the process compares favorably with resin ion exchange. So satisfied is Vitro with the performance, that the company has written solvent extraction into the 1,000-tpd Gas Hills concentrator proposal now before the AEC (which only recently announced that it was extending milling capacity in the U.S., allotting 1,700 tons to Wyoming).

Western Nuclear Corp. designed Slick Rock for 490 tpd feed which includes a generous factor for lost time due to remote power source and the uncertainties of ore deliveries during Wyoming winters. So far, the throughput has exceeded 600 tpd, due to the favorable sand-slime ratio of the ores.

Future capacity of this newest RIP mill will vary above and below that figure—a characteristic of RIP circuits being that they are extremely adaptable to wide swings in the slime content of the ore.

Edmund C. Bitzer, metallurgical engineer, Golden, Colo., who was a consulting metallurgist for Uranium Reduction Co., Moab, Utah, as well as for Western Nuclear Corp., states that—

"Western Nuclear has already demonstrated the adaptability of the RIP Process when the following points are considered:

"Plant was designed with only a limited pilot plant operation and, as events have transpired, this work could be eliminated in the design of future plants in favor of a careful program of batch testing.

"Successful operation has been attained on plant feed combinations and ore sources that were not available at the time the testing was done.

"Ores of radically different characteristics are being treated with a minimum of blending facilities, regardless of settling or filtering rates.

"Recovery of dissolved uranium in the CCD circuit cannot be equaled by any other system or combination of equipment. Capacity of the plant can be doubled within the area of the existing site.

"On the other hand, the process has certain limitations. It is best adapted to ores from which satisfactory leaching extractions may be made at a relatively coarse grind, and the minus 325-mesh fraction or slimes of clayey nature should not exceed a range of 30 to 40% by weight.

High Water Requirements

"An important requirement is an ample water supply because the minimum requirement is between three and four tons of water for every ton of dry feed. As pointed out in the article to follow, the feature that is not particularly attractive is the batch nature of the ion exchange step, but this is common to all resin processes. This need not be considered a permanent disadvantage because continuous ion exchange equipment is being developed.

"RIP is one of the major contributions of the AEC-sponsored development program for the use of our various uranium resources. It was an outgrowth of the work done to adapt ion exchanger resins for the recovery of uranium from South African gold residues, and the extension of this idea is strictly a development by American engineers aimed at the treatment of difficult domestic ores. Many of these could not have been profitably treated by any other method and there is no question but that the sudden impetus in plant design and construction in 1954 and 1955 was entirely due to the availability of the process which was utilized in five plants in succession.

"During this period, the pressure to get plants into production, and the need to develop special equipment and handling methods was not conducive to sound design. Some experience with the early plants has tended to obscure the peculiar advantages of the RIP process, and the recent design tendency has been to return to conventional methods of solution recovery with all of their operating problems.

"The experience of Western Nuclear has vindicated earlier prognostications concerning RIP and revealed attractive possibilities for improving the cost of operation. Indications are that the metallurgical possibilities are likewise far from being exhausted, in spite of the limitations imposed by available ion exchanger resins."

Following a discussion of Vitro Uranium's switch to solvent extraction, Mr. Bitzer will take over to discuss the design, operation and corrosion problems encountered in the Western Nuclear resin-in-pulp mill.

Solvent Extraction

acid leach-phosphate precipitation uranium mill. Plant is located on an 81 acre tract in southwest Salt Lake City with an additional 200 acres available for expansion.

Ore feed to the mill comes largely from independent miners in the Marysvale, Green River and Big Indian districts of Utah. Vitro also feeds some Wyoming ore from Vitro Mineral's holdings and other mines. All ore arrives by rail and is unloaded after weighing and sent either to stockpile or to the mill.

In going directly to the mill, ore is unloaded from gondola cars into a track hopper equipped with a car shaker. Ore is conveyed by the track hopper to the crusher where plus 1-in. feed is broken in a Cedar Rapids impactor closed by a vibrating screen. Screen undersize is sampled.

All conveyors in the plant are enclosed to reduce dust losses. A representative sample is obtained in the sample house—the split being taken in three successive stages as shown on the flowsheet. A modern assay lab has been installed and a process development laboratory established.

Ore is then stored in three silos from which feed is drawn as shown on the flowsheet.

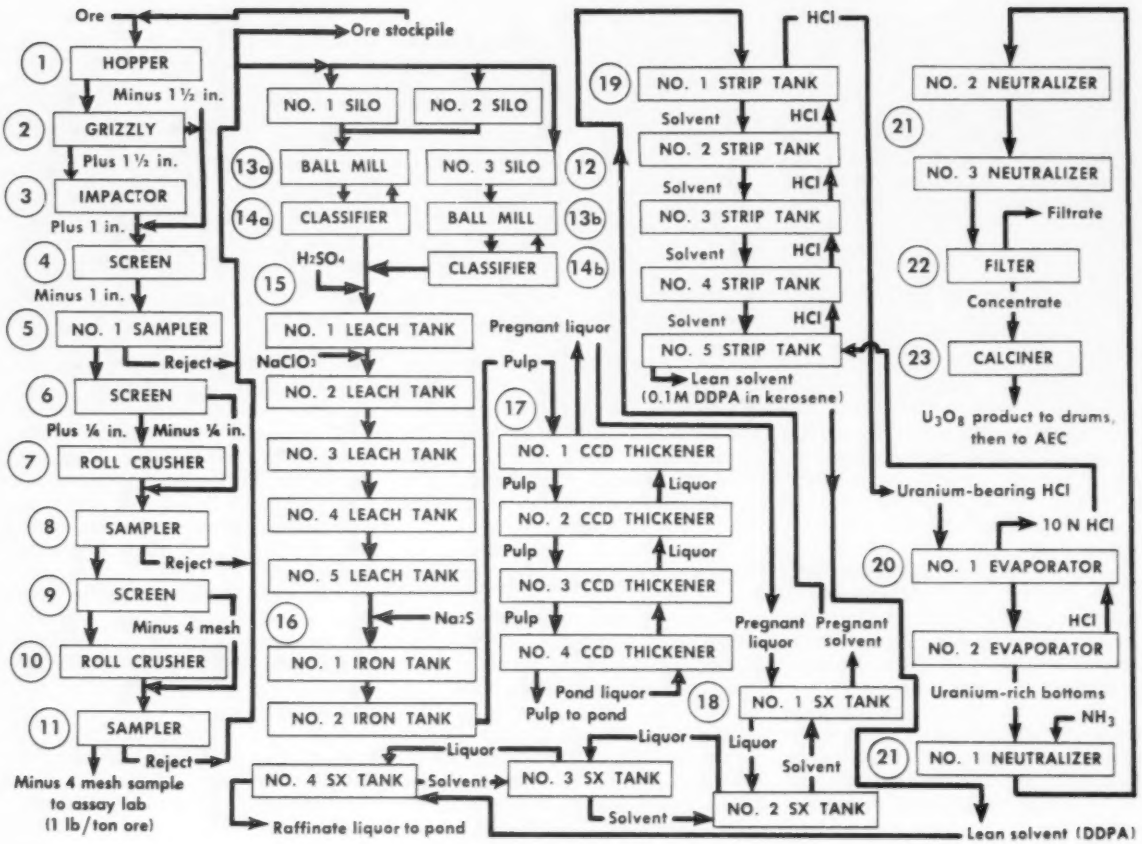
After the uranium has been leached, and extracted with solvent, it is stripped from the solvent with HCl. Acid is distilled in a novel evaporator and condensed for re-use—greatly reducing the reagent costs of the process.

Uranium-rich bottoms from the evaporators are treated under automatic controls to neutralize the solution with NH_3 and precipitate the uranium. Filtration and calcination yield a dry AEC-specification oxide.

Automatic Controls

In solvent extraction there are generally three variables which are most critical from the control standpoint—control of the interface between the two immiscible liquids; density control in the evaporator distillate; and flow control of solutions in the plant.

VITRO URANIUM CO., SALT LAKE CITY, UTAH
SOLVENT EXTRACTION FLOWSHEET



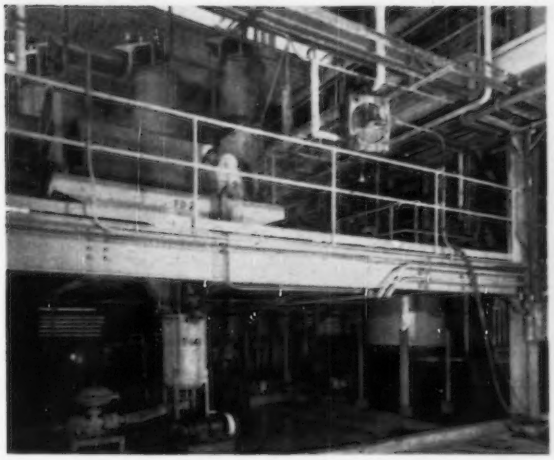
LEGEND

1. Railroad cars deliver ore from various mines to Salt Lake City where it is fed into 50-ton hopper. All new mine or goes through sample plant, and any ore withdrawn from the stockpile must pass through the sample plant again
2. Grizzly with 1½ in. openings
3. Cedar Rapids 30x30 in. impact crusher
4. Hummer screen, 1-in. openings
5. No. 1 sampler takes 10% cut, sends remainder of feed to silos or stockpile
6. Hummer screen, ½-in. openings
7. Roll crusher, 14x30 in.
8. Second sampler takes 10% cut; reject goes to silos or stockpile
9. Hummer screen, 4-mesh cloth
10. Roll crusher set at 4-mesh discharge
11. Final sampler takes 5% sample of minus 4-mesh fraction to laboratory for assay (1 lb/ton ore feed). Reject passes to silos or stockpile
12. Three silos store ore for mill feed. No. 1 and 2 hold 900 tons, No. 3 holds 500.
13a. Eimco 6x6 ft ball mill. Pulp at 50% solids
13b. Marcy 6x4½ ft ball mill. 50% solids
14a. Model C, Dorr rake classifier, 54 in.
14b. Akins 48-in. dia spiral classifier
15. Five leach tanks, approximately 10,000 gal capacity each, in series. H_2SO_4 is added to first; $NaCLO_3$ to second; and Na_2S to discharge of No. 5 duction takes place to prepare the solution for solvent extraction
16. Iron tanks—two tanks where iron re-
17. Four 70-ft dia Dorr-type thickeners in countercurrent arrangement. Pond water and fresh water are used to produce the pregnant liquor
18. Four solvent extraction tanks in countercurrent series. Barren raffinate goes to pond. Rich solvent goes to solvent strip section
19. Five-stage countercurrent HCl stripping tanks. 10 N HCl used. Lean solvent moves forward to SX section
20. Two-stage HCl evaporators recover HCl. Uranium-rich bottoms go to neutralization. Evaporators are made up of Karbate pipe and tube heat exchanger sections to form a falling film type evaporator
21. Three-stage agitated neutralization tanks. NH_3 added to No. 1
22. Eimco string-discharge vacuum filter
23. Calciner

Interface controllers in the extractor and strip tanks automatically maintain the interface at a desired level within the tanks. This control is a capacitance bridge instrument which measures the dielectric constant in the tank just as if it were a capacitance in a radio frequency circuit. Dielectric of solvent and water are different. The instrument senses the level of the interface and changes the level of the interface to keep it at the desired level.

Solution flows are controlled by instruments as well as by manual means if needed. In the case of the HCl addition to the stripping tanks, the acid-solvent ratio is maintained automatically by a ratio controller which changes the amount of acid whenever the amount of solvent entering the tank changes.

Density controllers in the evapora-



NEUTRALIZED diuranate is separated and washed on an Eimco string-discharge rotary vacuum filter, then calcined.

VITRO URANIUM established a quality control and assay laboratory, and a process development group at the mill.

tors maintain the proper distillation end product by measuring the density of the recovered HCl as a means to regulate the steam addition to the evaporators.

Plant alarms warn the operators of any abnormalities in the circuits. A solvent extraction plant would be difficult if not impossible to run without some degree of automation, say Vitro engineers. However, with the highly instrumented design now installed, optimum operation within narrow control limits can be obtained consistently.

Western Nuclear Proves Worth of Resin-In-Pulp Ion Exchange

EDMUND C. BITZER

WESTERN NUCLEAR CORP., Jeffrey City Wyo. is processing ore by resin-in-pulp ion exchange in excess of its contract 440 tpd rate. In January 1958, Western Nuclear processed an average of 603 tpd with an average recovery of 92.6%. During February, the mill processed slightly more than an average 700 tpd with a 92.9% recovery. In March, the production was to be even higher.

Western Nuclear has proven the worth of the RIP process for a wide variety of uranium ores. Here's how Western Nuclear designed and operates the Slick Rock mill, and some of the corrosion problems encountered so far.

Purchasing and Storing Ore

Equipment

Drawing on p 97 shows the arrangement and nominal sizes of equipment in the crushing and sampling plant. It is similar to several installations at other uranium mills and has a capacity of 75 to 125 tons per hour of feed, depending upon the moisture and clay content of the material.

Mr. Bitzer is metallurgical consultant, Golden, Colo. He served as a consultant on both the Uranium Reduction and Western Nuclear Projects.

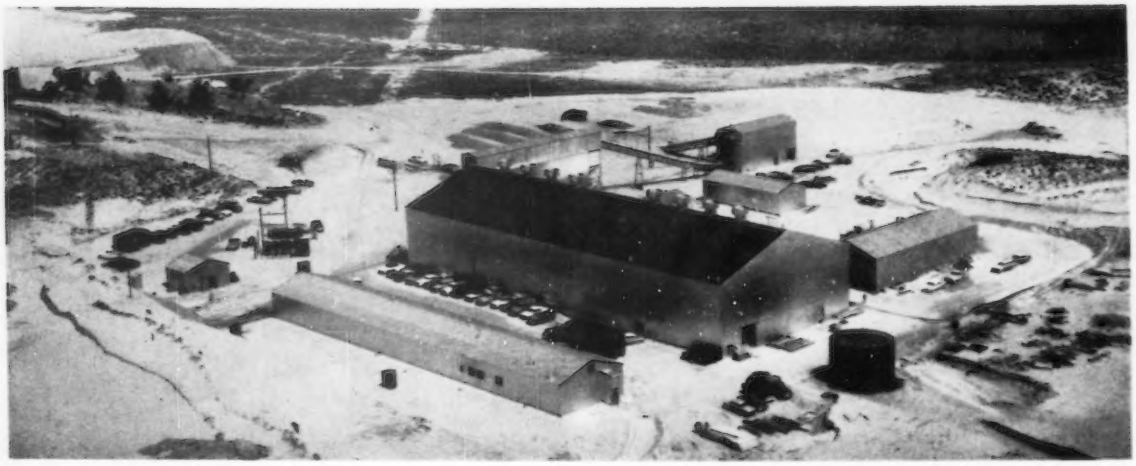
The plant is adequate for the purpose and to save time the design was accepted without too much study or redesign because similar plants were performing in an acceptable manner. The bucket samplers move on an endless chain and eliminate the necessity for a sample reject elevator, hence the plant is of the low headroom type and is very compact. In retrospect, however, it is likely that the conventional sampling tower would have been preferable had design time not been a factor.

In the event of plant expansion, several major changes are contemplated in the layout. These will include shifting the primary crusher to receive the feed directly from the truck hopper. The Wobbler feeder will be eliminated and a heavy duty vibrating screen will be used to scalp fines from the primary crusher feed.

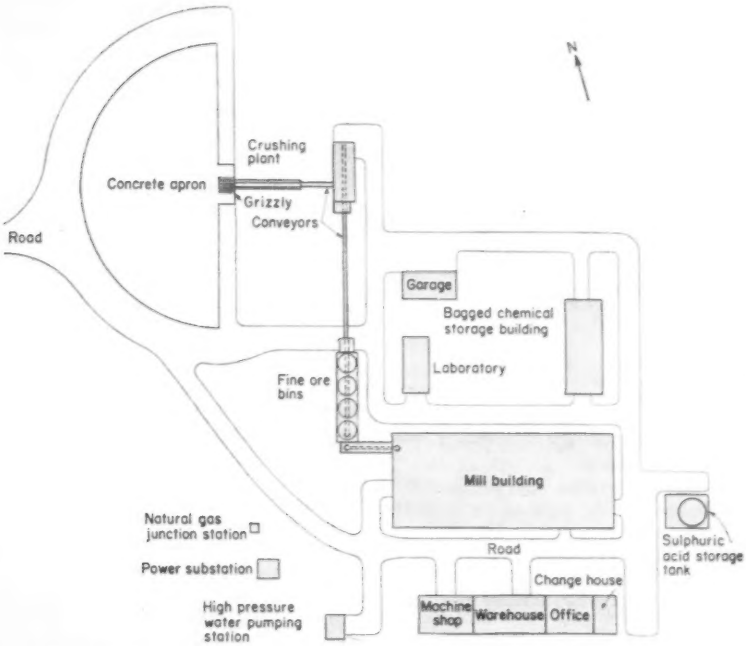
The fines and crusher product will then be fed to a gas-fired ore dryer ahead of the sampling equipment. The elimination of the drying equipment in the original design was a calculated risk to save on capital expenditure. The gamble has paid off but, as noted above, the capacity of the plant varies considerably, and damp ore in the fine storage bins has required additional labor from time to time.

Two equipment features deserve some mention in this section. At the outset, considerable difficulty was experienced with obtaining accurate weight splits from the secondary and tertiary samplers, caused by surges of feed over the screen following the primary bucket sampler. A small chute mounted on the feed end of this and the succeeding screen solved the problem and fortunately it was possible to balance both screens to compensate for the additional weight.

Conventional troughing idlers on all



WESTERN NUCLEAR is processing ore in excess of its contract capacity of 440 tpd, according to Robert W. Adams, president. In January the mill handled an average of 603 tpd. In February, the mill processed 700 tpd. March was even better.



PLANT CAPACITY can be doubled within the existing site. Acid tank is placed outdoors, draining from the mill foundation, with small shift-capacity tank in mill.

conveyor belts were abandoned in favor of "Limber rollers" supplied by the Joy Manufacturing Co. These have proved to be very satisfactory and promise to give long life with freedom from lubrication and maintenance problems.

A conventional belt tripper manufactured by Link-Belt serves the truck bin used for stockpiling special ores and the four storage bins ahead of the grinding circuit. The latter bins are equipped with an unusual and effective design of feeder. Essentially, it consists of a belt supported by a steel plate which extends under a slot for the entire width of the bin. The belt is rubber-covered on one side only, with the fabric side next to the plate support. Each belt is equipped with a 3-hp Reeves variable-speed drive.

Sampling and Accountability

Accountability for plant feed and grade is maintained by sampling in lots from individual shippers that are weighed in over a 50-ft truck scale. Portions of each sample are taken for the plant, shipper and umpire, and one portion is taken for a composite sample to determine the average grade to process for each monthly period. Sampling and sample preparation practices are in accordance with procedures agreed upon by the company and the AEC. The price of uranium concentrate varies with the average grade fed to process, hence the necessity for the monthly composite of the heads.

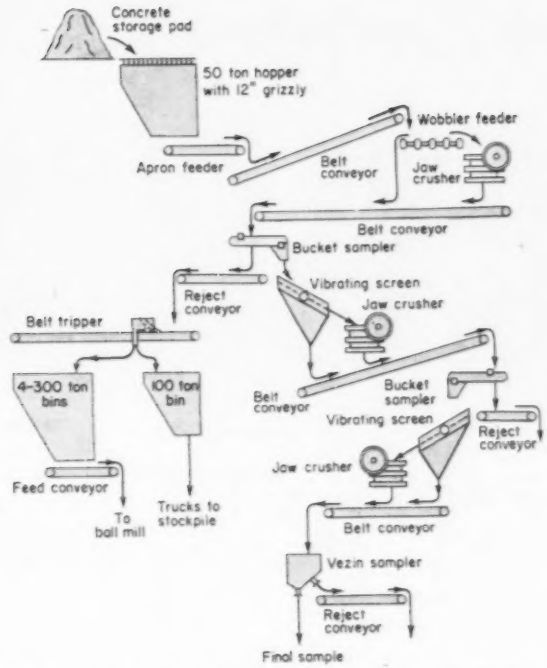
Dust collection at transfer points in the flow of ore is provided but the amount of dust collected has had no significance on head assays. Importance of this step has been greatly overemphasized in general but for obvious reasons it is a necessity for mills that receive custom ore

Grinding and Leaching

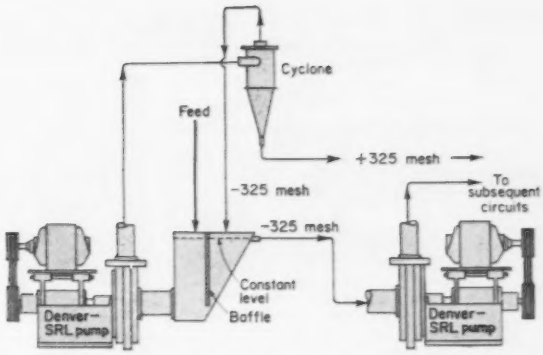
Equipment

Minus 2-in. ore is ground to about 5% plus 28-mesh in a 6x6 ft Deco ballmill which at present is lined for overflow discharge. Design is such that grates can be installed and the mill speed increased should greater capacity be needed. V-belt drive was selected to give the mill a range between 60 and 80% critical speed, and operation at present is approximately 70% of critical speed with a 125-hp motor.

Mill is in closed circuit with a 48-in. Wemco spiral classifier, operated at approximately 50% solids at the overflow. Overflow pulp is transferred to the leaching agitators by a 3-in. Wemco sand pump.



CRUSHING AND GRINDING plant is typical of those installed elsewhere on the Plateau and can handle 125 tph.



DIVIDED sump keep a full feed on the cyclone pumps at all times, prevents surging. Cyclone pumps are installed in pairs.

Nine 16x16-ft fir-stave tanks are arranged in gravity flow for acid leaching. Air lifts are provided as an optional means of pulp transfer, providing flexibility for inspection and maintenance purposes. Agitation is obtained by means of 60-in. Deco turbine type impellers in each tank.

Photograph on p 98 illustrates the general construction of the impeller which is designed to provide adequate mixing at moderate speeds and low power consumption. Mechanisms and impellers were selected on the basis of performance and low maintenance under similar conditions, and the manufacturer's claims for the design have been well substantiated.

The entire assembly in contact with the acid pulp is rubber-covered and the superstructure is so designed that the assembly can be removed as a unit for repair or replacement.

An upright cylindrical storage tank 20x30-ft has a capacity of 800 tons of sulphuric acid, located outside the main mill building with protective dikes and drainage away from all buildings. A small intermediate storage tank on the ground floor of the leaching section has sufficient capacity for a shift's operation at a rate of approximately 120 lb of acid per ton. Acid is pumped from the intermediate tank to a steady-head tank above the agitators. Acid feed rate is regulated by a simple time-volume method by means of a measuring tank at each point of addition.

Additions of oxidant, reductant and neutralizer for pH adjustment are currently made manually as required. When usages of these reagents are more firmly established, mechanical feeders will be utilized.

Operation

Equipment described above is extremely flexible for the operating conditions of a coarse grind and on ores that change in character very rapidly. At times the leach agitators will receive an extremely slime-free pulp and operate with clear solution at the surface. A similar condition will result if the ball mill operator loses control of classifier density which can happen for a variety of reasons. Power interruption of several hours duration seldom results in difficult starts for the mechanisms and air lancing after power interruptions are required only occasionally.

Sand-Slime Separation and Washing

Equipment

Sand-slime separation and CCD washing are accomplished in four Esperanza-type classifiers and two banks of 6-in. Krebs cyclones arranged according to the flow diagram on p 98. Each bank of cyclones is operated by a 5-in. Deco SRL pump driven by a 25-hp motor through an adjustable-pitch V-belt drive.

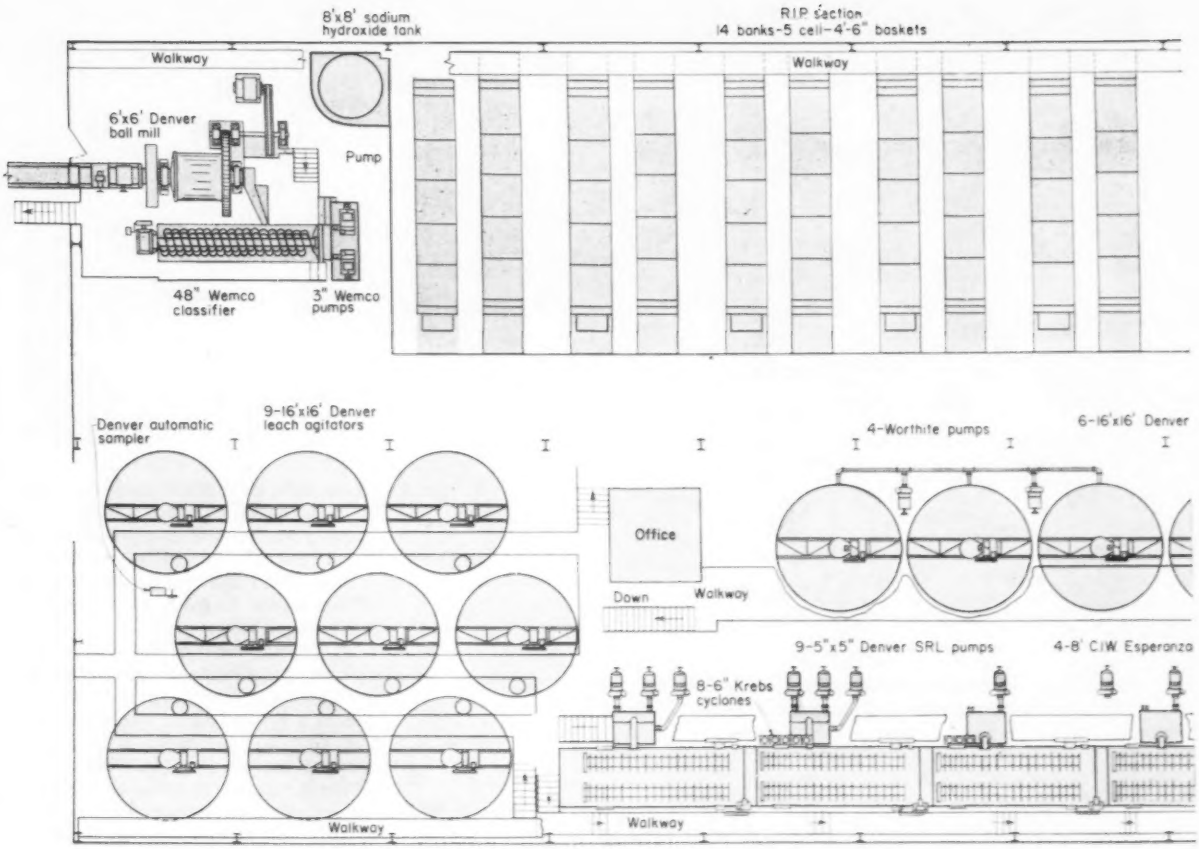
A general view of the pump and cyclone installation is illustrated on p 100. A very essential part of the system is a divided sump which keeps a full feed on the pump at all times and prevents surging (see above). All of the pumps are installed in duplicate except the one transferring the last classifier overflow which carries a very small amount of fine solids.

Esperanza classifiers are approximately 8 ft in width with a total pool area of about 125 ft. They are modeled after a design originally worked out by Knowles Associates, New York City, and were fabricated with modifications by Colorado Iron Works Co., Denver. This type of machine is ideally adapted to this particular duty, the reasons for which are outlined in the succeeding section.

Operation

Sand-slime separation is the heart of the RIP process and any irregularities in the size separation or volume of slime can cause a multitude of problems in the ion exchange section.

The arrangement shown was evolved by experimentation over a considerable period by the staff of the AEC pilot plant in Grand Junction, and this section has operated without attention and with few adjustments since the plant started. For this reason, there are few operating data so far as sizing is concerned, except that the cyclone overflow is delivered to the RIP section at from 6 to 8% solids and everything passes a 325-mesh sieve. RIP flow rate varies from 350 to 450 gpm, depending upon the slime content of the ore fed to process.



CORROSION on the Esperanza drags was reduced by raising the emf from 425 to 500. Author says rubber-covered castings are preferred over stainless pulleys.

Deco SRL pumps require gland water for operation and the selection of this type of pump is unconventional in that it introduces dilution at the wrong places in the washing system. So far this has had no adverse effect on soluble uranium losses, and the pumps are giving excellent trouble-free service. Most plants have installed glandless pumps for this duty at somewhat higher capital cost and at considerable sacrifice in pump efficiency.

Esperanza classifiers (see above) receive feed at the deep end of the pool and the overflow is removed from a submerged launder in the shallow end. This utilizes the principle of concurrent flow of sands and overflow which undoubtedly helps the separation, the aim of which is to settle the maximum amount of solids. Design and mode of operation is analogous to the use of densifiers in Heavy Media plants.

Overflow weirs are adjusted to carry the pool level as close as possible to the point of sand discharge so that there is a minimum of run-back to carry fine sands back toward the overflow.

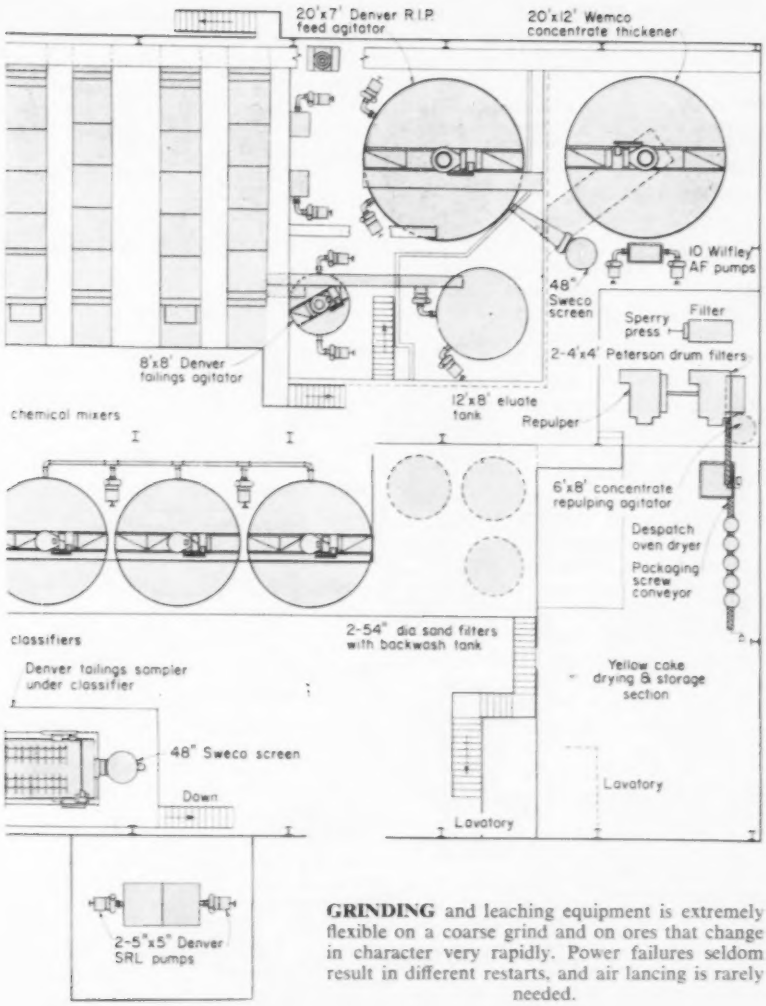
The 6-in. Krebs cyclones operate at from 20 to 25 psig and the underflow orifices are adjusted to discharge a thin, sloppy pulp that carries considerable minus 325-mesh slimes. This follows the same concept as the weir adjustment on the classifiers.

Primary objective in this section is an efficient CCD system and efficiency of sizing is detrimental from every standpoint. It was for this reason that the special Esperanza classifiers were designed. It would be possible to redesign and otherwise modify any of the standard mechanical classifiers but the special Esperanza machines actually cost less on the basis of pool area.

Resin-in-Pulp Section

Equipment

Fourteen banks of basket machines comprise the bulk of equipment in



GRINDING and leaching equipment is extremely flexible on a coarse grind and on ores that change in character very rapidly. Power failures seldom result in different restarts, and air lancing is rarely needed.

this section and are arranged for gravity flow between banks, commonly termed a cascade system. Drop between banks amounts to nine inches and has been ample to handle the required flow rate via 8-in. pipe between banks. All piping is heavy duty Uscolite with Keystone butterfly valves for routing flows. All pumps for handling RIP slimes are 4-in. Wilfleys, Type AF which are considered unequalled in performance for this service.

Baskets have nominal dimensions of 54 in. on a side and have a capacity of 20 cubic ft of wet-settled resin each. The machines have two unusual features not found in other designs. The first is that each bank contains five baskets—an odd number which necessitated a special type of line shaft drive.

Up until this time it has been deemed essential to employ an even number of baskets to achieve dynamic balance. The odd number has proved to be quite satisfactory although some difficulty was experienced during start-up with under-sized and poorly designed bearings. They have been replaced with suitable bearings and operation since has been satisfactory.

In designing the baskets, it was decided to abandon the original method of supporting the screens on a framework with close-spaced bolts to secure the cloth. In this instance, the screens are held in place under tension by conventional hook strips and tensioning bolts.

All five screens are interchangeable. The mechanical design has proven to be successful and two obvious advantages have been gained; first, the screens can be easily replaced; secondly, the easy change feature permits an experimentation with different types of screen cloth which is currently in progress. Original screens were fabricated from Tyler No. 5225 —a special weave with a rectangular openings.

Other than the two special features mentioned, the equipment is similar to machines in other plants. All stainless steel welded parts are specification 316 ELC. The screens are standard specification 316, and the tanks are constructed of vulcanized rubber-lined mild steel.

Operation

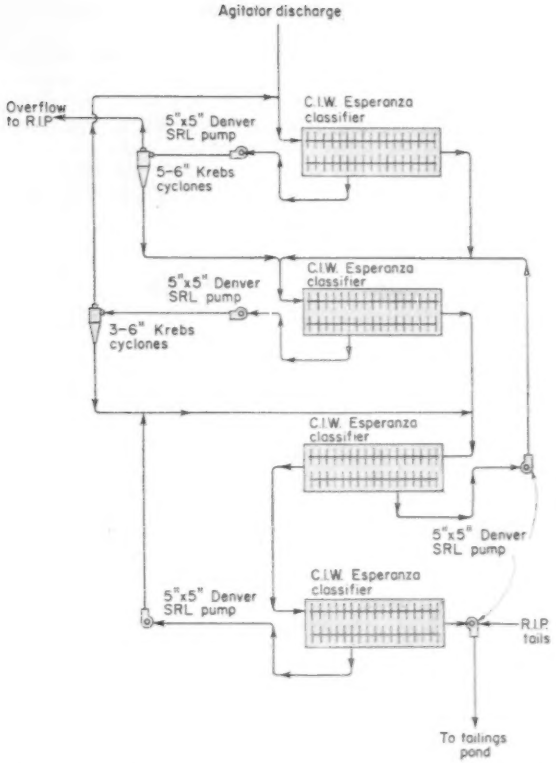
Eight banks are operated on exhaustion (uranium loading), five on continuous elution (uranium stripping), and one bank is on scavenger duty. Dowex 11 resin is employed and a loading of 2.8 to 3.0 lb U_3O_8 per cubic ft of resin is attained. Metallurgical control is maintained by adhering to a 2¾ to 3-hour changeover and varying the feed rate to the ball mill in accordance with the assay of the RIP feed solution so that the quantity of uranium processed does not exceed the capacity of the resin.

Current practice on changeovers is to dump the head bank in the exhaustion series to the RIP feed tank and put the bank on elution with only a superficial water rinse. Sand filters (p 99) take care of ore slimes remaining on the resin from the exhaustion operation and in theory this practice prevents precipitation of silica within the resin (which could possibly occur during a prolonged rinsing in water). Sand filters were originally intended to remove the insoluble coating introduced with the fertilizer-grade ammonium nitrate employed as the elution reagent.

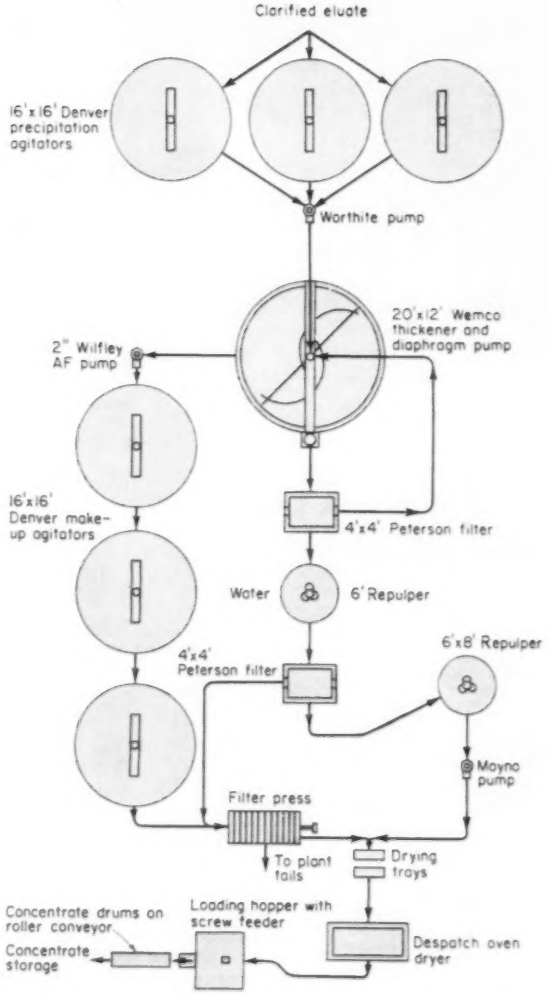
Experience in this section has paralleled that in other plants in that the basket screens blind with broken resin and trash, and resultant drainage and circulation in the machines leaves much to be desired. Regeneration with caustic soda relieves this condition temporarily but it is believed that the problem may be solved by the use of a different screen cloth weave.

Since before the first commercial RIP plant was designed, it was recognized that the use of the basket device as now known, and that the batch or semi-continuous nature of the operation was an expedient to meet an urgent demand in the first instance, and a compromise with sound milling practice with respect to the batch feature. The machines at Western Nuclear may prove to be the ultimate attainment in mechanical design and operating cost for this type of operation but they are not considered to be the final answer for the process.

Now that uranium milling has reached a stage where time is avail-



SAND-SLIME separation is made in four Esperanza-type drag classifiers and two banks of 6-in. Krebs cyclones arranged as above. Each bank of cyclones is operated by a DECO SRL pump driven by a 25-hp motor through an adjustable pitch V-belt. Classifiers were modeled after an original design made by Knowles Associates, and fabricated by Colorado Iron Works.



WITH the exception of the drying equipment, all materials used in the yellow cake handling circuit are stainless steel.

able for calmer and more considered planning, better machines and methods will be worked out. Inherent advantages and flexibility of the RIP process are such that this is an inevitable development.

Regeneration and Precipitation

Equipment

Identical tanks and mixing mechanisms are used for preparing fresh eluate and for precipitating yellow cake from pregnant eluate. Tanks are 16x16-ft wood stave construction, similar to the leach agitators (shown above). Mixing is accomplished with two sets of hardwood sweeps mounted at 90 deg with respect to each other on a stainless steel tubular shaft.

Bagged chemicals, ammonium nitrate and magnesium oxide used in this section are delivered on pallets by means of a 2-ton bridge crane which also serves the leaching section with dry reagents and maintenance supplies. An identical crane (see p 98) serves the other bay of the building, where the grinding circuit and basket machines are the major items of equipment.

Operation

Of the three eluate make-up tanks, one is onstream to the RIP section, one is receiving barren eluate from the yellow cake thickener, and one is available for addition and mixing of fresh nitrate, acid and water. In like manner one of the three precipitation tanks is on stand-by to receive clarified eluate, one is full and being neutralized with MgO, while the contents of the third is being transferred to the yellow cake thickener. Worthite pumps are used for transferring fresh eluate and yellow cake; Wilfley Type AF pumps serve for eluate clarification and transfer of barren eluate from the yellow cake thickener to the make-up tanks.

Fertilizer-grade ammonium nitrate is currently being used as a nitrate source for regeneration. It presents no problem in handling, but this advantage is offset by the fact that the coating on the prills amounts to about 3% of the total weight. The problem was recognized at the outset but this type of reagent was adopted to insure ease of start-up. As the operation matures, unprilled nitrate and different methods of handling will be tried to improve the costs in this section.

Magnesium oxide furnished by International Minerals & Chemical Corp. was selected as a precipitant because

of the demonstrated ability of the material to yield a filterable yellow cake at room temperature. Selection has been justified by operating results and a satisfactory grade of yellow cake has been consistently produced by simple single-stage neutralization and precipitation.

Handling Yellow Cake

Equipment

Arrangement of the major items of equipment in this section which has operated very well and requires only part time attendance by the precipitation operator, exclusive of the drying and packing of the final product, is shown opposite. Operation is simple and straightforward. With the exception of drying equipment, all materials used are of acid-resistant construction and all tanks are rubber-lined steel.

Operation

On account of the batch nature of the preceding regeneration and precipitation operations, the yellow cake thickener cannot be operated with the conventional method of overflow and provision is made for decanting clear barren eluate from openings spaced at about 2-ft intervals down the sides of the tank. It has been found that a small amount of Separan, dispersed in a wide feed launder over the thickener, has materially speeded up the clarification of each batch of yellow cake.

Since the thickener tank will hold several batches of product, the vacuum filters are operated intermittently, depending upon the density of the yellow cake pulp stored in the thickener and upon the status of storage in the succeeding drying operation.

The system is completely flexible and although exact operating records are not kept, the equipment probably operates about 25% of the total available time. Limiting factor or bottleneck in the equipment lies in the sand filters. It has been found that there is a limit to the flow rate that can be handled through the equipment which, if exceeded, will result in poor clarification and a drop in grade of product.

During the first weeks of operation, the grade of yellow cake was about 60% U_3O_8 but as improvements were made in filter washing and general operator experience, the grade has improved and seems to have leveled off in excess of 75% U_3O_8.

The oven dryer was selected after considerable investigation and weighing of the problem variables. Selection could have taken several routes since quite a variety of equipment is available for the duty. None of the various equipment items are entirely satisfactory in all respects when all variables —labor requirement, dust loss, capital and operating costs, and size of plant —are considered as a whole.

In this instance, the selection was made in the light of two important considerations, namely, the capital cost was low and, most important of all, successful operation from the very start of operations was mandatory.

The latter objective was achieved without any difficulty since the oven type dryer is fool-proof, positive, and dust loss is negligible. However, the tendency has been to over-dry the yellow cake and subsequent handling of the pans creates a cleanup problem. Several design changes in the dry handling equipment are projected to minimize the difficulty.

Original equipment included relatively shallow pans fabricated of black iron which corroded rapidly. They have been replaced with deeper pans of sheet aluminum which have resulted in more drying capacity and, after several months of use, the metal appears to be immune to corrosion.

Solving Corrosion Problems

It is necessary to approach this subject with some caution and humility. Corrosion of major importance has occurred in the Esperanza classifiers and the RIP baskets. Something of a paradox exists in these matters because, although corrosion specialists have not agreed as to the causes—and these may never be exactly determined—there is reasonable assurance that the problem in both places will be worked out satisfactorily.

Esperanza Classifiers

Very soon after the start of plant operation, the large tail pulleys on No. 1 classifier (which receives concentrated acid pulp from the leaching section) became discolored and corrosion has since proceeded steadily.

Soon after, the same thing happened to the pulleys on No. 2 classifier but the rate of corrosion has been very much slower. Pulleys of No. 3 and 4 machines have been unaffected. Conveying flights on all machines have also remained bright with the exception of those on No. 4, which have taken on a copper-colored hue but show no signs of deterioration.

All of the stainless steel involved is type 304—the flights are fabricated of rolled sections and the pulleys are foundry castings. To complete the picture of the general conditions, it should be remembered that wash water is added to the pool of No. 4 machine and is counter-currented to No. 1; hence, the acid concentration is highest in No. 1 and decreases progressively.

The first investigation of the corrosion led to the discovery that as each flight dipped into the pool an appreciable current was generated between the flight and the pulley or pulley shaft. This led to the assumption that the difference in composition between the steel in the flights and that in the pulley, coupled with the strong electrolyte in the pool, resulted in a galvanic cell. This appeared logical since the amount of current generated in No. 3 and 4 machines was measurable but very small.

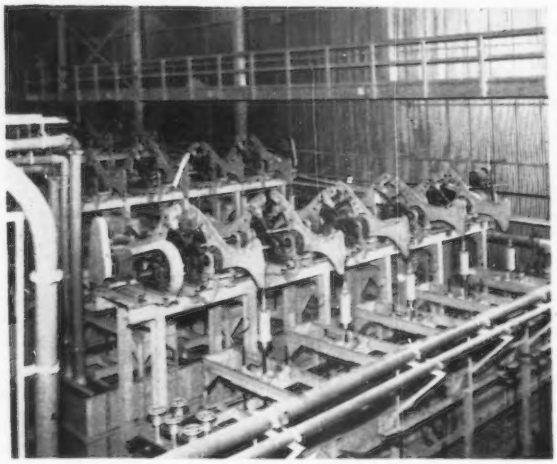
Corrosion in these machines was completely unexpected, particularly since identical machines in the Uranium Reduction Co. plant had never given any trouble in this respect. However, a comparison between the two installations revealed one major difference, in that the machines of Western Nuclear are supported by timber substructures, whereas the others rest on steel supports which may result in better grounding of stray current.

Accordingly, a separate and positive ground wire was attached to the pulley shafts and connected to rods well grounded outside the building. This had no apparent effect and current flow could not be detected in the ground wire.

Another theory was advanced with respect to the generation of the current. It was pointed out that the face of the pulley was protected by the endless rubber belt during a portion of the rotation and that this created a condition of oxygen "starvation" on the face with respect to the unprotected surfaces and that an emf potential existed between those two surfaces which resulted in generation of direct current. Further assumption was that some constituent in the leach liquor was probably the basic cause of the difficulty.

Whatever the cause, it has been decided that the only certain remedy is to substitute rubber-covered castings for the existing stainless steel pulleys. It now appears that this would have been the logical course to follow in the original design since fabrication costs would have been lower.

One last observation concerning this particular subject will serve to emphasize how little is firm in our knowledge of corrosion and how difficult it is to design for acid service. Leaching practice has recently been altered to raise the terminal emf from



EPOXY RESIN is used to combat corrosion at the point of contact between the screen cloth and rubber-covered frame.

RECENT inspection of the Denver Equipment rubber-covered impellers in the leaching tanks revealed no noticeable wear.

around 425 to 500, or higher, with no change in the terminal pH (1.0). The black scale on one of the pulleys of No. 1 machine disappeared completely and exposed clean, bright metal coincident with the change in leaching practice; the companion pulley, on the other hand, was unaffected.

Resin-in-Pulp Baskets

Standard 316 stainless steel screen cloth is supported at intervals by cross members of the basket frame which are fitted with removable soft rubber strips to furnish tight contact between the screen panels and sides and bottom of the frame. After several weeks of operation, a loss of resin led to examination of the baskets and severe corrosion to the point of screen failure was found where the screen was in contact with the rubber-covered support bars.

Reason for the corrosion has been unanimously diagnosed as oxygen starvation or "crevice corrosion," analogous to the diagnosis of corrosion on the classifier pulleys mentioned above. Temporary relief from this difficulty has been obtained by painting a strip of protective coating on the screens where they come in contact with the rubber-covered supports. An epoxy resin, Carbomastic No. 3, has worked well for this service but it is not the final answer since there is a tendency toward flaking and spalling of the coating.

An experiment with screen woven from Hastelloy "C" wire is currently in progress and another basket equipped with uncoated 316 wire is also installed as a control in the test. There is a possibility that the effect of more oxidant in leaching may influence corrosion in this section as it has in the Esperanza classifiers.

Equipment Maintenance

Except for the corrosion problems described above which appear to be under control, the prospects for low maintenance costs are very good because replacements due to abrasion after seven months of operation have been exceptionally light. Recent inspection of the leach agitators revealed no noticeable wear on the Deco impellers or the wooden wear plate on the bottom of the leach tanks.

The Deco SRL pumps, most of which are on severe service on the cyclones and tailing disposal, have required only minor replacements involving wearing sleeves. One pump impeller was damaged by accident and had to be replaced but otherwise the wear on the rubber parts to date is not noticeable.

It has been necessary to replace one impeller on the Wilfley pumps handling RIP slimes but since these are of stainless steel construction this can be considered excellent service. Recent improvements in the operation of the sand-slime classifiers will reduce the amount of fine granular sand in the RIP feed which should reduce wear on these pumps.

As mentioned previously the selection of major acid equipment items was made, so far as possible, on the basis of performance elsewhere. Competitive prices were considered but did not dominate the selections and the effect of this policy is becoming apparent.

How the Company Is Organized

Western Nuclear Corp. was organized originally in 1955 as Lost Creek Oil and Uranium Co. by a group of Wyoming businessmen headed by Robert W. Adams of Rawlins, president. Split Rock uranium mill is the first uranium oxide producer in Wyoming, and is the product of the perseverance of the original group who assumed the risks of mine exploration and negotiation of a contract with the AEC.

Further risks had to be taken with interim financing and the first stages of mill construction before the necessary bank loans could be arranged. In this latter connection, Thomas Hildt Jr., vice-president of the Denver investment banking firm of Bosworth, Sullivan & Co., and one of the directors of Western Nuclear, deserves special mention.

In addition to Mr. Adams, the executive officers of the company are Col. W. W. Fertig, executive vice-president; E. A. Smyth, secretary; and F. O. Griffin, treasurer.

The uranium mill is located about 70 miles northwest of Rawlins and two miles off U.S. Highway 287 leading to Lander, Wyo. and Yellowstone National Park. There are ore deposits in Crook's Gap about five miles south of the mill, but the major source of feed for the plant is in the Gas Hills district, some 25 miles to the north.

Initial operation of the mill has yielded very satisfactory results, and credit for this belongs entirely to a competent staff headed by J.W. Joyce, mill superintendent, who has had a long and successful record in milling both uranium and base metal ores.

Marcelle Smith is general foreman in charge of mill operations; P.N. Thomas is chief metallurgist; M.E. Cenis is master mechanic; and L.C. Knocke is chief chemist. The office staff is headed by W. H. Jones Jr.; and W.L. McFarland is in charge of

warehousing and requisitioning of supplies. Maintenance and general labor is in charge of Orville Cooley.

The mill treats company-controlled as well as custom ores, and the engineering and mining staffs are located at the mill site also. John Hudson is chief engineer and Eric Newman is chief geologist. R.T. Brown is mining engineer, and Harold Johnson is civil engineer. Jerry McDonald is mine pit foreman.

How the Milling Process Was Selected

One of the steps in negotiating the milling contract with the AEC consisted of test work to determine the general metallurgical characteristics of the ores then known and available. Prior to this time such testing had been sponsored by the Commission in the pilot plant at Grand Junction, where it is possible to simulate a variety of processes and gain some knowledge of applicable design factors. To avoid delay in negotiations, the testing was done in this instance at company expense by the Colorado School of Mines Research Foundation.

Tests were limited by equipment (and budget) to laboratory-scale acid leaching followed by a small, continuous leaching and filtration operation to verify extractions established in the laboratory and to obtain a sufficient quantity of pregnant solution for ion exchange amenability tests.

Limited pilot tests established that satisfactory extractions could be obtained, also that the acid pulps would be very difficult to handle by filtration or thickening to effect solution recovery. Aside from leaching requirements, there were few data available upon which to base a plant design.

Resin-in-pulp process was recommended because several plants were in successful operation with this treatment and the amount of money budgeted for test work was not sufficient to do any further work on solution recovery methods.

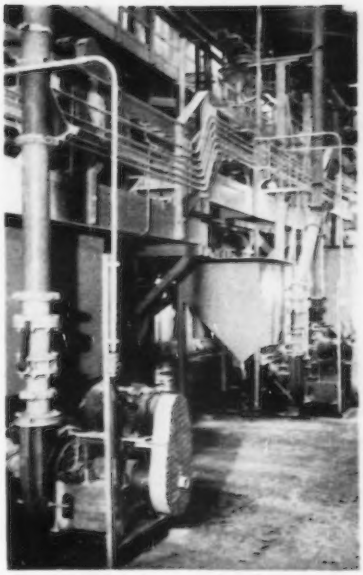
Another risk involved in the planning was the knowledge that the ore sample was probably not representative of feed that would be available for the mill as the known orebodies were developed at depth.

In view of the general lack of firm information on mill requirements, certain design precepts were rigidly followed, under company direction.

1. It was assumed that the sand-slime ratio of the acid pulps would be unfavorable and that a high flow rate would be encountered in the ion exchange exhaustion step. Therefore, the classification and ion exchange equipment was selected and designed on this basis.

2. All available operating information was obtained from similar plants by an inspection tour to evaluate design features and performance of equipment, particularly the latter.

3. So far as possible, only equipment that had been proven in operation by other plants was specified for purchase. This later proved to be an important factor in getting the plant under way at capacity operation.



DECO SRL pumps on severe service have required only minor replacement.

Planning and engineering phases were concerned almost entirely with mechanical details and the results have been very gratifying. To date, no serious metallurgical problems have been encountered that were not anticipated in the ore testing by the Research Foundation — demonstrating that RIP technology has matured to the extent that plants can be constructed without involved pilot testing although, as is shown above, there will always be a need for improvements in design and equipment.

The co-operation of the operating staffs of other uranium mills during this phase of the project was of great assistance. Particular acknowledgment is due to the following operations: Kerr-McGee's Shiprock plant; the Tuba City plant of Rare Metals Corp.; and the Moab, Utah operation of Uranium Reduction Co.

Something of a record for uranium plants was established in construction. Ground was broken at the site early in November 1956, and the plant was in operation early in July, with fair stabilization in August 1957—a lapse of about nine months. Basic preliminary design was completed in August 1956, but delays in financing held up final design and prevented an earlier completion date. Engineering and construction was performed under contract by Western-Knapp Engineering Co., a subsidiary of Western Machinery Co., San Francisco.

An important factor in construction speed was the fact that overhead cranes were installed as soon as the steel for the main building was erected. These were specified primarily for handling operating and maintenance supplies but proved to be a boon during construction as attested by the fact that the cables of both cranes had to be replaced before plant operation was begun.

Utilities

Power is furnished for the mill and townsite by the REA and a line of 25 miles was installed with a capacity of 800 kva. Total power consumption amounts to about 23 kwh per ton milled, including the water supply. Natural gas was available from the Northern Gas Co. Water is obtained from two well systems, one at the townsite, which is located on the highway two miles south of the plant. The wells for milling use are located about 3,000 ft from the plant and an 8-in. main feeds a 200,000 gal storage tank, half of which is reserved for fire protection. Water was found at moderate depths (150 to 200 ft) and the supply is ample for a much larger operation.

The mill is situated on a ridge overlooking meadows along the Sweetwater River to the northwest. A natural depression in the form of a draw southeast of the plant is ideal for tailing storage and was dammed to form a basin with a capacity of about 1.5-million tons below the plant floor. Pond is near the top of the draw so there is little danger of floods from natural runoff.

Plant Layout

Drawing on p 96 is a plant sketch showing the grouping of the various components of the operation. The arrangement allows for expansion of fine ore storage and the mill building. Water storage is at sufficient elevation to furnish the bulk of process water by gravity and a pumping station is provided for fire protection and general service, including pump gland and cooling water. The main sulphuric acid storage tank is located outside the mill building and in a spot such that possible spills from unloading operations will drain away from all buildings.

Can Modern Metallurgical Methods Revitalize the Meadow Lake Area?

A. L. WISKER

THE ALMOST INNUMERABLE quartz-tourmaline veins of this once famous but nearly forgotten district contain an appreciable undeveloped tonnage of gold-copper ore (in the $12 to $25 value range) worth re-examination and consideration today. Re-evaluation is suggested because in 1865, when announced discovery of $60,000 gold ore caused the wildest mining "stampede" in California history, the only method available to the miners for recovering gold was amalgamation. Satisfactory for treating ores of the extremely shallow oxidized zone, the process was absolutely useless in treating the deep-seated, dense, primary, complex sulphides. Their complexity is set forth in the accompanying spectroscopic analysis of one sample, taken at one spot on the outcrop of one important claim.

Although not reported, the following six additional elements were certainly present: gold, silver, sulphur, hydrogen, oxygen, carbon—a total of at least 28 of the 92 elements, all in a 5-lb sample!

The veins occur in a granodiorite batholith, a minor satellite of the great Sierra batholith. The veins owe both gangue minerals and metallization to mineralizers emanating from the hyperabyssal mass, which is partly roofed with diabase in which appear several similar veins arising from the underlying granodiorite. This geological condition is similar to that of Grass Valley's famous Empire-Star mine. At Meadow Lake, dip on 20 veins of a well-known group averages 70 deg; ore width averages more than 5½ ft and reaches 19 ft on one or two veins. Both vein and country rock are extremely hard, requiring little timbering—a condition favorable to mining as deep as is usual with hypothermal ores anywhere in the world.

Within three years after discovery the hysteria of the Meadow Lake boom had largely subsided, after the location of 1,200 claims, construction of eight stamp mills (capacity 4 to 20 tons per day), and the building of a town housing 5,000 at its population peak of 1865. For many miles the mountains had been pock-marked with countless prospect holes, but rarely was high-grade free gold ore found. Slowly it dawned on the people that their mills were not able to make high-percentage recoveries from ores rapidly increasing in sulphide content, although many mill runs had shown recoveries of from one to two ounces gold per ton. With the coming of each winter, with its deep snows, Meadow Lake City (incorporated by the legislature in 1866) lost most of its population; each spring saw a smaller return; by 1872 none were left but a few "die-hards," including Henry H. Hartley, discoverer of the Meadow Lake veins, whose trip to Virginia City, Nev., in June 1865, with samples assaying up to $60,000 per ton, sparked the "stampede." Until his death in 1892, Hartley maintained his unshakeable belief that a great mine, locally treating the complex sulphides, would eventually be developed in this most highly mineralized area of California. Time may prove his faith well founded. Such multiplicity of persistent and well-defined veins of workable widths, all bearing gold and other valuable minerals, supports that conviction.

A condition precedent to realization of Hartley's dream must be patient and thorough geophysical examination, directed by highly-qualified geologists and covering an area of about 20 square miles. In all its long history Meadow Lake district has never received such examination—and but perfunctory attention from men who could be regarded as top-rank geologists. If Meadow Lake measures up to its geological indications, a smelting operation is essential; and the high capital investment must be protected by an examination unequivocably establishing every pertinent fact essential to success of such an enterprise. Of course, consideration of recovering every commercial by-product is involved in such evaluation. Copper, arsenic, cobalt, and sulphuric acid may have by-product value. Development may disclose other values.

The accompanying table gives data resultant from well-conducted sampling of less than 3% of outcrops of known veins, assays being confined to

Mr. Wisker is a mining engineer with headquarters in San Francisco, California.

Table I. Spectroscopic Analysis of Meadow Lake Sample

Silicon	more than 10.00%*	Iron	more than 10.00%*
Aluminum	1.00%	Sodium	1.00%
Potassium	.10% to 1.00%	Copper	.10% to 1.00%
Boron	.10% to 1.00%	Manganese	.10%
Calcium	.10%	Magnesium	.10%
Molybdenum	.01% to .10%	Vanadium	.01% to .10%
Arsenic	.10%	Lead	.01%
Chromium	.01%	Zinc	.01%
Titanium	.01%	Nickel	.001% to .01%
Cobalt	.001% to .01%	Tin	.001%
Gallium	.001%	Strontium	.001%

*Not determined closer when exceeding 10%.

Table II. Assays Based on Samples Taken From Outcrops of Veins in the Meadow Lake District

Ore	Sampled	Pay	Length	Pay	Tons	Metal per Ton			Avg.
					Ft	Oz	Oz	%	$
Shoot	Length	Length	Pay %	Width	Depth	Au	Ag.	Cu	Value
Claim A..	120	120	100	1.00	12	.9428	.40	*	33.36
Claim B..	300	200	67	11.25	225	.4166	.25	*	14.81
Claim C..	950	550	58	5.52	304	.4186	.25	*	14.88
Claim D..	380	160	42	3.16	51	.3909	.60	*	14.22
Claim E..	80	72	90	5.30	38	.3914	.26	*	13.94
Claim F..	825	510	62	5.30	275	.2480	1.20	1.4	16.76†
Totals..	2,650	1,612			905				
Weighted average			61%	5.62 ft.					$15.67

*—indicates copper in small quantity, amounts not determined. †—copper priced at 25c per lb.

gold, silver and—in one area—copper. Areas assaying less than $5 are excluded as waste in evaluating but add to value when used as flux.

Although a few million tons of ore in the partly-oxidized zone may be profitably treated by flotation, fine grinding, and cyanidation, the ultimate and most efficient metallurgical process for the Meadow Lake ores is smelting. And the principal properties of the area should be under a single administration for economy.

Back in 1902

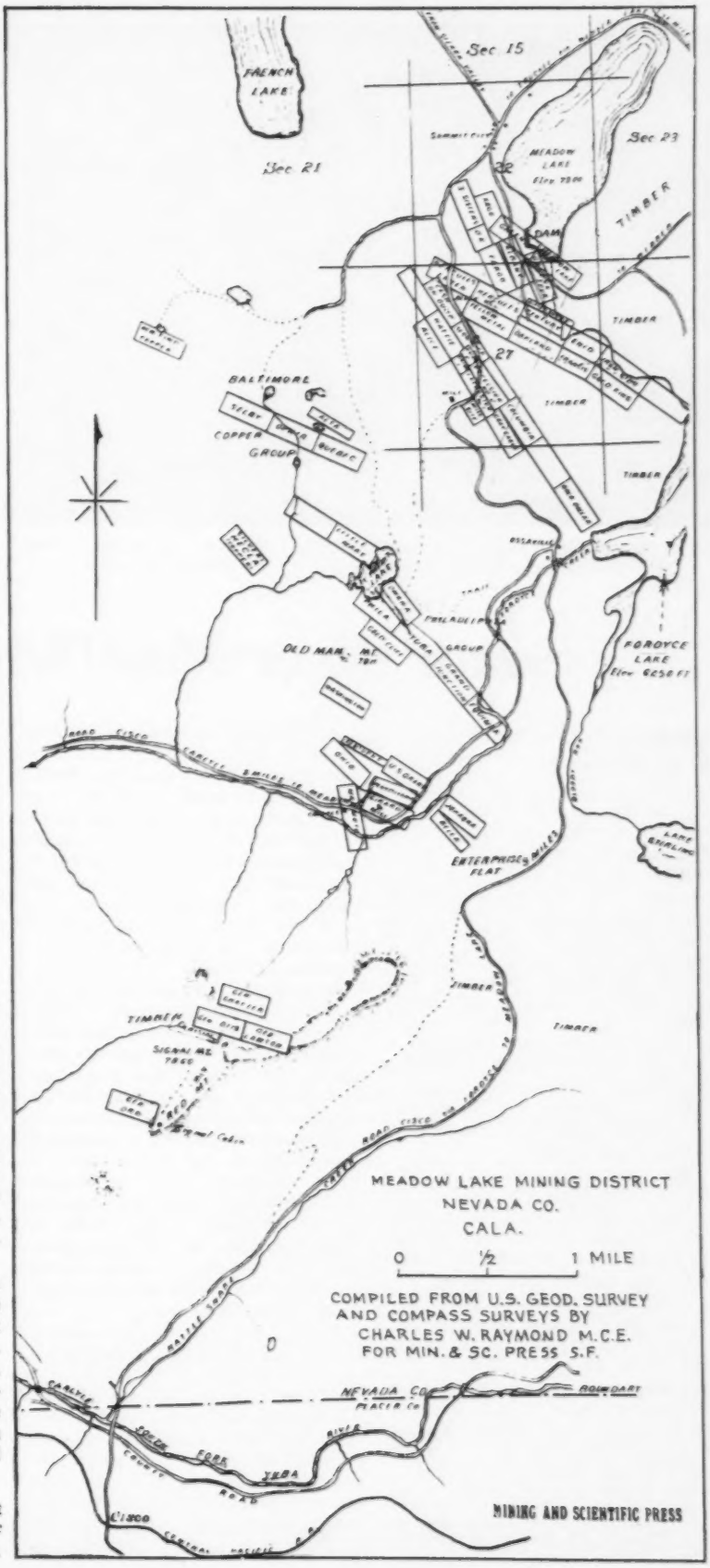
Editor's Note: Strangely enough, the very re-examination which Mr. Wisker suggests in this article was recommended by C. W. Raymond who wrote as follows in the *Mining & Scientific Press* of Jan. 25, 1902:

"After an interval of more than 30 years the mining district of Meadow Lake, Nevada County, California, seems to be coming to the front once more, and if the continuation of the work for the past 18 months produces the results indicated, this district will undoubtedly become a producer of gold and once more a noted mining camp of California. Meadow Lake has long been discredited. Many explanations have been given and none has been favorable enough to suggest its reinvestigation. It has been said to be a district of "ill defined veins," "of no depth," "with no values," a climate severe beyond imagination, "inaccessible," and the ores of which, even did they contain values, unworkable, because of their rebellious and refractory nature."

Writer Raymond objects, however, and says "this reputation is undeserved" because the veins and vein systems are well defined and important, the ores carry gold values and often high grade, and that these values can be extracted without any complicated and expensive process.

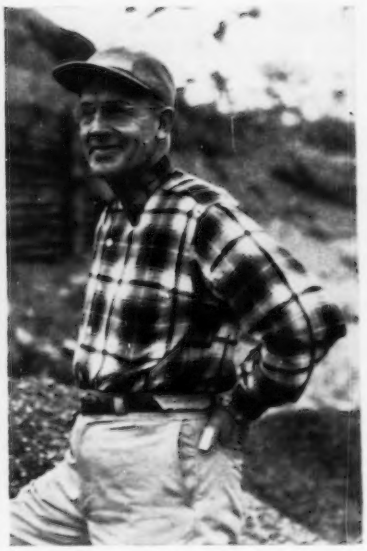
This contention is supported by five printed columns of detailed information and facts pertaining to assays or ores, and metallurgical recoveries of bulk samples by amalgamation and chloridization methods.

His conclusion: "In conclusion it would seem that the Meadow Lake district offers considerable inducement for investigation and investment . . . the ore is present in large quantities, and the extraction of gold is practicable by ordinary, well known, simple and inexpensive methods."—With copper at 24c, zinc at 10c, and lead at 12c, what are we waiting for?



AREA MAP of Meadow Lake District reproduced from *Mining and Scientific Press*, Jan. 25, 1902.

VESUVIUS MINE is producing again, shipping its 130 tons per hour output to the U.S. Government's Carload Purchasing Program for domestic manganese.



RICHARD C. SPURGEON, of South River Mining Co. developed the mine.

South River Mine Whips a Tough

RICHARD C. SPURGEON
E. J. O'CONNELL

SOUTH RIVER MINING CO., Vesuvius, Va., is combatting a tough ore and the regional hazard of sticky mud to produce 130 tph of manganese concentrates from its mine and mill in the western foothills of the Blue Ridge Mountains. In recent history, domestic manganese producers have been unable to compete with foreign sources except in times of war and of drastically increased steel capacity.

Under the National Carloading Program, the Federal Government is paying a basic price of $2.30 per long ton unit for metallurgical grade concentrates (see Table I).

The following article is devoted solely to the processing methods developed to handle the Vesuvius Mine ore. For history of the mine and drilling and mining background, see p 109.

Process consists of crushing to 3 in., washing and scrubbing, crushing to ½ in., washing and scrubbing, removal of minus 20-mesh and separation of the ½ in. by 20-mesh at a specific gravity of 3.3 to 3.4. The final concentrate is ½ in. by 20-mesh, has a specific gravity greater than 3.3 or 3.4 and a chemical analysis which meets the specifications in Table 1.

The major mineral dressing problems involved in concentrating this ore are:

1. Dirt and clay must be disintegrated and removed as a waste.

2. The manganese nodules must be crushed for liberation but primarily to expose the interstitial fillings which are usually high in alumina, iron and occasionally phosphorus.

3. The interstitial filling exposed by crushing must be disintegrated and removed.

4. The clean manganese particles must be separated from gangue, which is primarily quartz, and from middlings. Middlings are an intimate mixture of fine silica grains in a manganese matrix. A gravity separation on this type of feed is somewhat difficult because of: 1. the high separating gravity (3.3 to 3.4); 2. fine feed (½ in. by 20-mesh); 3. amount of material in the feed which has a specific gravity near the specific gravity at which separation has to be made for maximum recovery of manganese as a concentrate which satisfies specifications (see Table 1).

Washing-Crushing Plant

Trucks or scrapers dump through a 12 in. stationary grizzly into a concrete box with a sloping bottom and an open end. Water (80 psi nozzle pressure) is used to move the feed into a launder and break up the more easily disintegrated mud. The grizzly prevents large pieces from entering the feed launder. The use of a bin and a mechanical feeder is not possible because the mud packs solid when slightly wet. Pieces which pass over a stationary 3 in. grizzly in the bottom of the feed launder drop into a toothed, single roll crusher set to 3 in., which is about the top size which can be fed to the log washers without causing mechanical damage. The toothed single-roll type of crusher was chosen because it has the least tendency to plug on a muddy feed. The minus 3 in. underflow from the grizzly and the crusher pass to a double deck, inclined, vibrating screen with ½ in. and ⅛ in. round holes. The top deck prevents large pieces (plus ½ in.) and an excessive tonnage from falling on the ⅛ in. screen decking; the ⅛ in. hole on the bottom deck is a compromise between selection of a hole size which will not blind and one which will retain the manganese which can be recovered with the subsequent equipment; the amount of recoverable manganese coarser than 20-mesh which will pass the ⅛ in. hole on this screen is not large enough to warrant a smaller hole size. However, the South River management is making periodic checks on the underflow from this screen. As noted on the flowsheet, minus ⅛ in. solids passing through this screen are flumed to the tailings pond.

The 3x⅛ in. oversize drops into the lower (or "pool") end of the primary log washer where most of the

Mr. Spurgeon is general manager of South River Mining Co. Mr. O'Connell is a sales engineer, Western Machinery Co.

HIGH PRESSURE WATER moves tacky ore from concrete dumping pit.

DOUBLE DECK SCREEN, Hewitt-Robins 4x16-ft Elliptex, receives ore from the secondary log washer. Minus 20-mesh material goes directly to tailings.

Manganese Ore Problem in Virginia

clay (mudballs and particle coatings) is disintegrated. Just before the scrubbed ore drops through the discharge hole at the upper end of the machine, it is washed by a bank of water sprays. The slurry of spray water and fine clay particles overflows at the lower end of the log washer tank.

Plus ⅛ in. solids in the primary log washer overflow are removed by a single deck scalping screen and flow to the secondary log washer in a flume line. Scrubbed ore from the primary washer is reduced to ½ in. by two roll crushers in series and fed to the secondary log for removal of the interstitial fillings. Secondary log washer overflow is wasted to the tailings pond as it is finer than 20-mesh, and the raked product passes over a heavy media feed preparation screen for a spray washing to remove slimes and minus 20-mesh solids; minus 20-mesh material from the feed preparation screen is sent to the tailings pond and oversize is fed to the heavy media plant which is a Wemco No. 2M Mobil Mill. Since the feed preparation screen is horizontal, all freely draining water is removed from the heavy media feed.

A noteworthy feature of the washing-crushing plant is the screening of the primary log washer feed and overflow. Removal of fines from the crushed feed (minus 3 in.) wastes very little manganese and results in superior scrubbing conditions in the log washer. The large volume of water from the high pressure nozzle, an excessive percentage of plus ⅛ in. material in the raw feed and a particularly viscous mud will cause the primary log to overflow plus ⅛-in. solids; without the overflow scalping screen this material would be wasted. Since the primary log will usually set the over-all plant capacity, the use of those two screens is a most valuable addition to this flowsheet.

The only water added to the secondary log washer is through sprays on the drainage deck, so volume of overflow is quite small. However, the solids in the overflow are secondary fines so there is a certain percentage of recoverable manganese in the 20x 100-mesh size range. Investigation of a method for treatment of this overflow and the feed preparation screen undersize is presently under way.

It will be noted from the flowsheet that the primary and secondary log washers are arranged for different types of scrubbing. The primary log is on a 3 in. slope and rotates at approximately 28 rpm to give the best compromise of retention time and maximum scrubbing conditions for a 3 in. feed. The intense agitation caused by the high log washer speed and the absence of minus ⅛ in. rock in the feed results in disintegration of practically all of the mudballs and removal of most of the particle coatings. The primary log washer's principal task is to disintegrate mud balls.

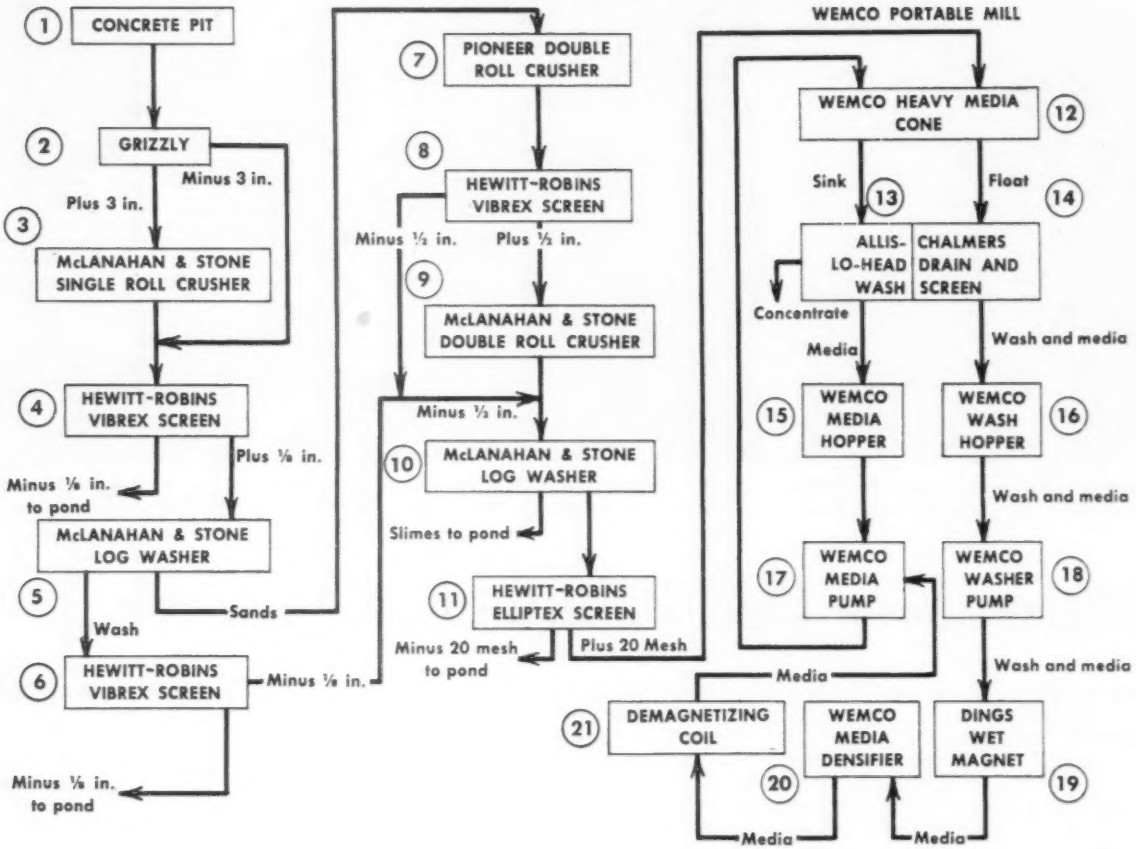
The Wemco Mobil Mill is a pre- at a slope of 2-½ in. per foot and rotates at approximately 20 rpm; the effect is a comparatively gentle, heaving action with ½ in. material. Principal task to be accomplished in the secondary machine is removal of particle coatings missed by the first log washer and removal of interstitial fillings exposed by crushing to ½ in. The heaving action and the absence of fines results in a rubbing motion which effectively removes the particle coatings.

Heavy Media Plant

The Wemco Mobil Mill is a prefabricated arrangement including all equipment, steel, stairways, piping, etc. necessary to separate a material on the basis of specific gravity. The structure has been extended to include the feed preparation screen. This particular plant is a most recent design including a drum type, electric magnetic separator mounted over the densifier and open top pump sumps for the media return pump and the wash hopper pump. Control of all equipment in the heavy media section (including the feed preparation screen) is from a centrally located panel board handy to the operator.

The 20-mesh oversize from the feed preparation screen drops into a 7-ft Wemco cone separator. The cone contains a slurry of fine ferro-silicon particles and water which effectively

SOUTH RIVER MINING CO.
VESUVIUS, VA.



LEGEND

1. Concrete pit in which mine ore is dropped. High pressure water nozzle sluices feed into grizzly
2. Grizzly with 3-in. spacings
3. McLanahan & Stone 21x42-in. single roll toothed crusher (40hp)
4. Hewitt-Robins double deck 5x12-ft Vibrex screen (7.5hp), ⅛ in. openings
5. McLanahan & Stone 3x30-ft primary log washer; 3-in. slope, 28 rpm, 60hp
6. Hewitt-Robins 4x10-ft single deck Vibrex screen (7.5hp)
7. Pioneer 40x24-in. double roll crusher
8. Hewitt-Robins 3x6-ft single deck Vibrex screen (2hp)
9. McLanahan & Stone 18x18-in. double roll crusher (25hp)
10. McLanahan & Stone secondary log washer; 3x30-ft, 2.5-in. slope, 60hp
11. Hewitt-Robins 4x16-ft double deck Elliptex screen (15hp)
12. Western Machinery heavy media cone, 7-ft dia, 3hp
13. 14. Divided Allis-Chalmers Lo-Head drain and wash screen, 3x16-ft, single deck, 5hp
15. Western Machinery Co. media hopper with adjustable diverting plate
16. Western Machinery wash hopper with adjustable diverting plate
17. Western Machinery 4-in. media pump (25hp)
18. Western Machinery 2-in. wash hopper pump (7.5hp)
19. Dings drum type 30x24-in. electromagnetic separator (1.5hp)
20. Western Machinery 2x17-ft Wemco densifier (1.5hp)
21. Demagnetizing coil (4-in.)

duplicates a heavy liquid having a specific gravity of 3.3. The pieces of rock with specific gravities greater than 3.3 sink and enter a vertical, airlift pipe. The lighter pieces (less than 3.3 sp gr) float to the surface of the pool and are removed by an overflow opening on the periphery of the cone. Some of the ores on the property require separation at 3.4 instead of 3.3; when treating these ores, the specific gravity of the artificial "heavy liquid" is changed by altering the ferrosilicon (sp gr 6.7) water ratio. The airlift is simply a vertical pipe open at both ends and situated at the axis of the cone; the submerged end is near the apex of the cone and receives the mixture of sink and medium which is elevated to the top of the pipe by compressed air from jets in the cone bottom.

The cone separator overflow (float product plus medium) and airlift discharge (sink product plus medium) flow through separate launders to a horizontal, vibrating drain and wash screen which has a punch plate deck with 1/32 in. holes. A longitudinal division plate prevents mixing of the float and sink. Medium drains through the first portion of the screen and is sent back to the cone by the medium return pump. Float and sink pass under a bank of water sprays above the center section of the screen for removal of adhering ferrosilicon. Wash water passes through the screen and is pumped (wash hopper pump) up to the "cleaning circuit" for reclamation and dewatering of the ferrosilicon and rejection of slimes and fine rock particles. The last portion of the screen is reserved for draining water from the float and sink particles.

A large percentage of any slimes or rock fines (minus 1/32 in.) in the cone

separator feed will pass through the drain section of the screen and become a part of the medium. This results in a medium consisting of three components instead of the theoretical two-component medium mentioned previously; namely, ferrosilicon (sp gr 6.7), rock slimes (sp gr 2.6 to 3.4) and water. An increase in the ratio of rock slimes to ferrosilicon will decrease the specific gravity and increase the viscosity of the medium; in particular, the colloidal type slimes have a marked influence on the viscosity. A highly viscous medium will result in low recovery because it prevents the finer sink particles from sinking to the bottom of the separating bath. The slimes or rock fines problem is most critical at the higher separating gravities as the viscosity of a ferrosilicon-water medium with a specific gravity of 3.4 is quite high in itself; the amount of viscosity increase by rock slimes which can be tolerated when separating a ½ in. by 20-mesh feed at 3.4 is lower than the allowance of, for example, a 2.8 medium.

The adverse effect of an unduly large amount of rock slimes is eliminated by constantly "cleaning" a small percentage of the medium. This is accomplished by an adjustable diverting plate underneath the drain and wash screen which allows the operator to divert some of the medium passing the drain section to the wash hopper pump. Since the feed preparation screen does an excellent job, the amount of medium cleaning required at South River is quite small. The diverting plate is usually adjusted once or twice during an eight-hour shift.

The "cleaning circuit" consists of a drum type, electric magnetic separator, a Wemco densifier and a demagnetizing coil. The magnetic separator removes some of the water and practically all of the rock slimes. The magnetic concentrate, ferrosilicon, is dewatered in the densifier and returns to the cone (via the medium return pump) after deflocculation in the demagnetizing coil. The densifier overflow is close-circulated with the magnetic separator by passing to the wash hopper pump. The densifier is a spiral classifier modified for specific use with ferrosilicon medium and includes an adjustable spiral lifting device to regulate the amount of dewatered ferrosilicon returned to the cone separator. Since the densifier overflow is close-circuited with the magnetic separator, the operator can raise the medium gravity quickly by passing a portion of the medium return pump discharge to the densifier; the amount passed to the densifier is regulated so

How South River Brought in the Vesuvius

History of the mine as a producer is long and sporadic. A report dated July 11, 1901, indicates that there was an underground mine and jig mill at the property. In 1917, the mine was reported closed, but about to reopen. USGS records show that approximately 16 carloads were shipped in 1919. In 1928, the workings were reported flooded and unworkable. One or two carloads were shipped from Vesuvius in 1940 and then the mine apparently was untouched until 1954 when South River Mining Co. took over. Production began in 1956.

The geological structure of the Vesuvius area is described by Dr. W. A. Nelson, consulting geologist of Charlottesville, Va. as a series of anticlines and synclines trending northeast. The synclinal area of the fold occurring on the Vesuvius property is occupied by the weathered Tomstown dolomite and a concentration of manganese ore in clay from that dolomite.

The manganese originally occurred, Dr. Nelson believes, as a carbonate and was later taken into solution and redeposited at favorable structural places. Prominent minerals are pyrolusite, psilomelane and, occasionally, limonite and wad. Manganese is present as irregular lumps and fine particles in the mud matrix. Many of the irregular lumps are in the form of nodules with botryoidal surfaces.

Exploration called for a drill which would yield an accurate sample from all horizons and for a sample evaluation technique which would give results that might be expected from a washing and gravity concentration plant.

Core recovery was found to be too low in diamond drilling, and auger drilling would smear a thin ore seam over the entire hole length. A "bucket drill" rig was hired, with its crew, for $15 per hour. The bucket drill makes a 3-ft dia hole and must be dumped every three feet. Pieces as large as seven inches will pass freely into the bucket, but troublesome ones must be pried loose by an operator who rides the bucket to the bottom of the hole. When a particularly large rock resists breaking, the drill must be moved.

South River drilled 64 holes on approximately 50-ft centers, with some going to the maximum depth of 80 ft. (Drilling beyond 40 ft shows a substantial increase in cost per foot because of mechanical alterations to the rig.) Usually, the rig would drill two or three holes 80 ft in one eight hour shift, but one 22-ft hole took 105 minutes in tough clay and a 5-ft rock bed.

Channel samples were obtained on a few holes by a man riding the bucket. However, standard procedure was to take samples right from the drill, reduce them to one cubic ft and wash them in a small concrete mixer to remove clay and dirt. After crushing to three-quarter inch, all minus one-quarter was removed (Government specifications do not allow shipment of fines). A high iron fraction was removed by a hand magnet and the ¾x¼-in. nonmagnetics were then immersed in a slurry of ferrosilicon and acetylene tebrabromide for a specific gravity separation at approximately 3.2. Final concentrate was ¾x¼-in., nonmagnetic and with a specific gravity greater than 3.2. Drilling and test work indicated that the property could be profitably developed and operated.

Test work was arranged to produce a final concentrate by separation at a specific gravity of 3.2 because this is the highest, accurate separating gravity one may expect in a heavy media plant treating fine material and using a ground ferrosilicon media. At 3.2, only part of the deposit could be concentrated to specifications (see Table 1). However, additional testing at 3.3 to 3.4 indicated that the entire deposit (including surface ore) could be successfully concentrated.

Mining is open pit. Equipment consists of two No. D8 Caterpillar Tractors pulling 20-yd No. 80 Caterpillar scrapers. A one-yard shovel, (and trucks as required) was rented on an intermittent basis to develop the mining site for use of the scrapers. Stripping amounts to removal of trees and roots as the efficiency of the processing plant allows treatment of practically all other material on the property. Rain poses a problem as the clay beds become quite soft and slippery with a very small amount of water; this is one of the reasons for pulling the scrapers with D-8's instead of rubber-tired movers. The two 20-yd scrapers haul more than enough to feed the plant 130 tons per hour so the excess is placed on a stockpile. When one of the D-8's is required for stripping, road-building, etc., the other feeds the plant from the stockpile.

Government support of the domestic manganese industry has kept some of the U.S. mines in operation. Under the National Carloading Program, the U.S. is presently paying a basic price of $2.30 per long ton unit for metallurgical grade concentrates.

Historically, domestic producers have been unable to compete with foreign production except in times of national emergency.

IN THE MOBIL MILL, a seven-inch Wemco cone separator contains a slurry of rounded ferrosilicon particles and water.

DICK SPURGEON checks material at the drain and wash hopper which follows the cone. Note diverting plate and spray.

I. General Specifications U.S. Carloading Program

Manganese (40% Min.)	48.0%
Iron (16.0% Max)	6.0%
Phosphorus (0.30% Max)	0.12%
Silica plus alumina*	11.0%
Copper plus lead plus zinc**	1% max.
Price per long ton unit	$2.30

*No maximum specified but above 15% is usually unacceptable.

**Of which not more than 0.25% can be copper.

NOTE: Premiums and penalties on manganese, iron, phosphorus and alumina plus silica to give an approximate price range of $1.96 to $2.36 per long ton unit. Not more than 15% passing 20-mesh.

II. Size Analysis "Round Ferrosilicon"

Mesh	
Plus 48	0.3
48 x 100	3.0
100 x 150	11.7
150 x 250	25.0
Minus 250	60.0

III. Process Plant Results For Different Ores

(In tons per hour)

	Strip ore*	Digging ore
Washing plant feed	150.0	150.0
Washing plant waste	131.0 to 110.0	131.0 to 106.0
Heavy media feed	9.5 to 20.0	9.5 to 22.0
Heavy media sink	1.5 to 5.0	3.5 to 10.0
Heavy media float	8.0 to 15.0	6.0 to 12.0

*Low grade stripping material; ore in the sense that it can be processed at a profit.

Large fluctuation in plant results from ore occurring in "pockets."

the combination of densifier overflow and wash water from the screen does not overload the magnetic separator.

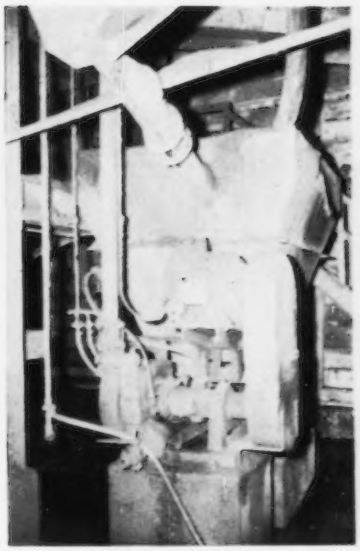
The float material drops into a surge bin and is trucked to a stockpile. Sink drops onto a short belt conveyor with a magnetic head pulley; the belt is usually operated as a simple conveyor but the operator may turn on the magnetic head pulley if he deems it advisable to remove a high iron magntic fraction from the concentrate. The concentrate is trucked to a nearby railroad siding for shipment to the Government stockpile.

A feature of the heavy media practice at South River is the use of a rounded ferrosilicon produced in Germany by Knapsack-Greisheim. A size analysis of the ferrosilicon as supplied from the factory is shown in Table 2. The rounded grain minimizes the tendency of the ferrosilicon to settle or segregate and gives the separating medium a comparatively low viscosity. European operators are reported to have made accurate separations as high as 3.75; one private report mentions holding a separating gravity of 4.00 though it was considered too viscous for an accurate separation. South River has been able to hold a separating gravity of 3.6 during an experimental run. Usual practice at South River calls for a medium specific gravity difference of 0.1 to 0.2 between cone top and bottom and a separating gravity of 3.3 to 3.4, depending upon the particular ore being treated. With a varying feed tonnage, the operator is able to maintain a separating gravity within a range of plus or minus 0.01 by making minor adjustments; occasionally the separating gravity has been held constant for a complete eight-hour shift. Eventually, a surge bin ahead of the feed preparation screen will give the heavy media section an even feed rate.

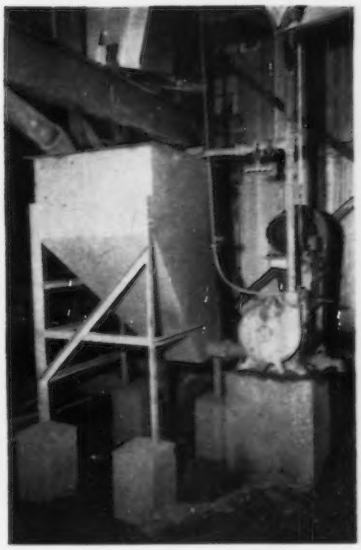
The modern Mobil Mill design and German ferrosilicon complement each other in making the heavy media section one of the smoothest operating parts of this plant. Start-up time is only 20 minutes because the rounded ferrosilicon grain has a minimum tendency to pack and because the plant design incorporates liberal use of both high pressure and low pressure air jets. Wear on the media return pump seems to be minimized by the rounded ferrosilicon grains. Mounting the magnetic separator over the densifier instead of under the wash water hopper eliminates the necessity of pumping the thick ferrosilicon slurry from the magnetic separator to the densifier and places the magnetic separator on the operating floor for easy surveillance and maximum elevation of the magnetic separator tailings. The cleaning circuit (wash hopper pump, magnetic separator and densifier) was designed to allow use of a large amount of spray water for removal of ferrosilicon from the surface of the float and sink particles.

Ferrosilicon loss has been approximately three-fourths of a pound per ton of feed to the cone separator including all start-up losses, non-magnetics, etc.

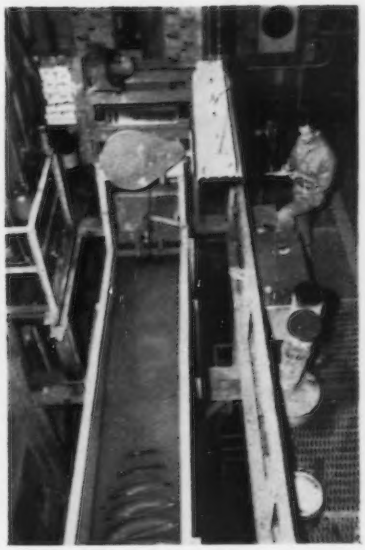
The reject or float is not acceptable to the Government program but there is a possibility of developing a private domestic market for this material. By retreating the reject at a specific



PUMP SUMP for the 4-in. gnedia return pump, which returns to the cone.



PUMP SUMP for the 2-in. wash hopper pump, which reclaims ferrosilicon.



DENSIFIER is close-circulated with the magnetic separator for control.

gravity of 3.0 to 3.1, a product, which assays 30 to 40% manganese and 15 to 25% silica can be produced. When a market for this material is developed, South River will probably rerun the reject by putting on an extra night shift for the heavy media section. Tests indicate that the reject material produced by a rerun at 3.0 is practically clean of any black manganese particles and might be sold as a concrete aggregate.

At some time in the future the fines presently sent to the tailings pond will be fed to a spiral classifier for extraction of all material coarser than 100-mesh. This will prolong the life of the tailings pond and present the possibility of selling the reclaimed material as a fine masonry or plaster sand. There is also the possibility of extracting some of the fine manganese from this reclaimed material and sintering it so that it will be acceptable on the Government program. South River is presently investigating the various processing schemes that might be used for this arrangement.

There are 15 men, including supervisors, on the payroll. The process plant requires one operator for the high pressure nozzle, one operator for the washing-scrubbing section, one operator for the HMS section and one man for general trouble shooting. Supervision includes Dick Spurgeon, manager; Bob Kisner, washing plant and general maintenance superintendent; Harry Pfieffer, supervisor of the heavy media section and disposal of finished concentrate; Richard C. Spurgeon Sr. and Bob Ferry supervise exploration and mining. Officers of South River Mining Co. are Richard C. Spurgeon Sr., president, G. E. Robertson, treasurer, and L. J. Schwartz, secretary.

Mr. Spurgeon Sr. and Dick Spurgeon have brought the property from a raw prospect to a finished mine. E. J. Maust, consulting metallurgist with Western-Knapp Engineering Co. in New York City, arranged the basic processing scheme.

New Ferromanganese Producer Has Begun Output

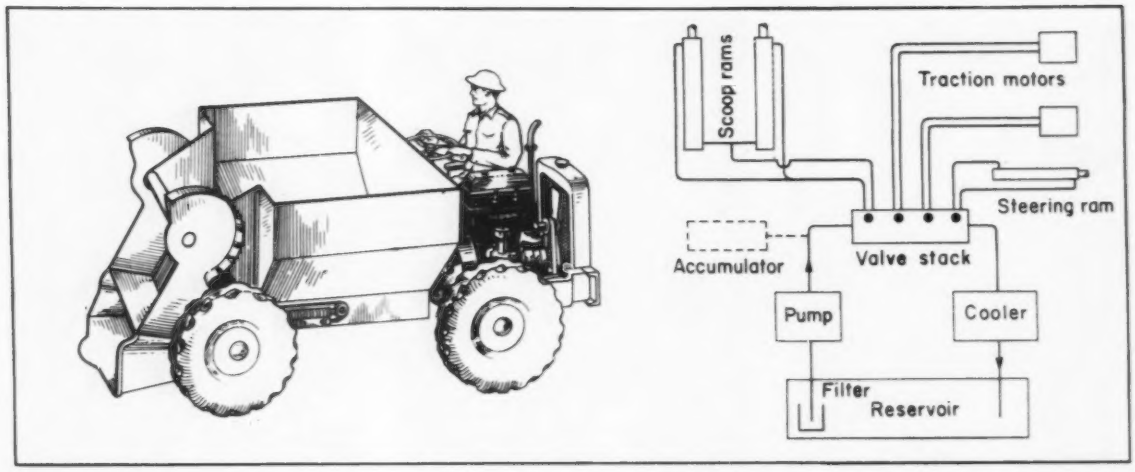
AT THE END of January, Pittsburgh Coke & Chemical Co., Neville Island, Pittsburgh, Pa., completed the rebuilding and adapting of an existing blast furnace and entered the ferromanganese market. Total cost of the changeover was about $2.5-million, with half of the cost being spent on the gas cleaner.

Pittsburgh Coke's blast furnace has a capacity of 400 tpd of high-carbon ferromanganese, or 600 tpd spiegeleisen (the low manganese allow), or 900 tpd of pig iron. Unit is 95 ft high and 22 ft dia at the hearth. Two bell-shaped valves at the top open alternately to feed ore, coke and limestone into the furnace. Off gases are used in a checker works to preheat incoming air for the tuyeres, and then to provide process heat through the system.

Molten metal and slag are tapped every six hours into special refractory-lined gondolas where the ferromanganese is allowed to cool for 24 to 48 hours. Controlled cooling is necessary in ferromanganese production. Ferromanganese, if cooled rapidly, breaks into too many fines. Proper control permits large chunk production, which is desirable in the deoxidizing use of ferromanganese. Some fines are used in alloy production.

Assuming the role of a "good citizen" of the Pittsburgh area, Pittsburgh Coke developed and patented, in cooperation with Chemical Construction Corp., a combination drop out hopper and Venturi scrubber to clean all exit gases. Scrubber forces gases through water film at 200 to 400 fps, cleaning the gases to 0.01 grains per cubic ft (compared to 0.20 grains permitted in the "Keep Pittsburgh Clean" campaign).

Sometime ago, the company formed a wholly-owned subsidiary — Neville Ferro Alloy Co.—to handle ferroalloy marketing to the steel industry. "Since steel is fundamental to our . . . economy," a company spokesman said, "and since manganese is essential to steel production, this . . . should offer a significant growth possibility for the company." Pittsburgh Coke's furnace is only the second non-captive ferromanganese unit in the U. S. About 13.3 lb of manganese is used in every ton of steel.



HAULER-DUMPER can operate at distances of 250 to 500 ft from the discharge point. Smaller unit can haul 30 tons 500 ft in one hour at a cost of four dollars, and can work comfortably in drifts not exceeding 8x8 ft with grades up to 15%.

Self-Loading Hauler Is Efficient

CHRISTIAN G. KUEHN JR.

MAJOR FEATURES of this patented, cost-saving, easy-to-handle self-loader and dumper (Pat No. 2,712,876, July 12, 1955) are that: (1) it eliminates gear transmissions, clutches, and other formerly used power transmissions, (2) it has hydraulic oil operated motors for driving machine's traction wheels, (3) it has controls for selectively driving all or only a portion of the traction wheels, (4) machine speed is increased when only a portion of the wheels are driven—engine and pump speed remaining substantially constant, and (5) its loading scoop or bucket is hydraulically lifted. The loader's features are specifically intended to approach the low operating costs usually limited to much larger machines working at their intended capacities.

Two sizes have been planned for loading and hauling 50 to 500 tons per shift, at operating distances of 250 to 500 ft or more from the discharge point. The smaller unit is expected to operate for direct costs of $4 per hour, can load 30 tons and haul it 500 ft in that time. It can work comfortably in drifts not exceeding 8x8 ft and in stopes providing 7 ft clearance with grades up to 15%.

Power source may be electric motor, gasoline engine, or, preferably, diesel engine. This motor or engine drives only two things; the light generator and a suitable hydraulic pump. This pump in turn activates hydraulic motors of standard design for both two and four wheel drive, the loading mechanism, and steering. No mechanical linkage exists between engine and working elements; no transmission, drive shaft, or clutch is necessary. The machine may be stalled repeatedly under load without risking any damage, and direction of motion may be reversed at will by simply reversing a lever which controls direction of oil flow to hydraulic traction motors.

Rate of oil flow to hydraulic rams and motors is infinitely variable between zero and maximum. Therefore, the optimum forward crowding of the machine, with simultaneous optimum dipper motion, are easily combined by the operator to produce the action for fastest loading. Tramming speed, up to the maximum permitted by mechanical design, would be limited by condition of roadbed, grades, and visibility.

Hydraulic accumulators in the circuit tend to smooth out the power demands on the engine, and actually store up a portion of the power not needed during part of the cycle for use during others parts of the cycle. When a diesel engine is used underground, this feature should tend to reduce fume by allowing a smaller engine to be used, and by utilizing that engine more efficiently.

These units work best in open stopes on flat-bedded ore mined through 7 to 9 ft thicknesses, with random pillars. Advantages are that no set-up time is required; as soon as a heading has been scaled, mucking can begin and will continue until the faces are once again clean, ready for drilling.

An average development round pulling 8 ft in an 8x8 ft heading makes about 30 tons of muck. This would be cleaned out and hauled 500 ft in approximately one hour.

In longer drives, provision can be made for dumping away from the face and reloading and hauling to final dump while drilling progresses. Thus, advances of 16 ft per shift are easily attainable with one unit, when headings are up to about 1,200 ft from dump point. Direct cost of loading, hauling, and maintenance under these conditions would be about $2 per foot of drift advance, or less than the cost of laying 20 pound rail in a conventional haul drift.

Major elements of the machine are well protected against mechanical damage, for they are cushioned against shock by the nature of the hydraulic circuit, or, being hydraulic elements, they are fully enclosed and are always completely lubricated by the hydraulic oil. Greatest maintenance items are tires and the metal faces exposed to rock's abrasive erosion.

General Features—Small Unit

Capacity	2 cu yd, struck
Power	30 HP
Oil Pump	30 gpm @ 1000 psi
Wheelbase	5 ft 9 in.
Width, maximum	5 ft 4 in.
Length, maximum	10 ft 3 in.
Height, maximum loading	7 ft 0 in.
Height, minimum	4 ft 6 in.
Speed, maximum	6 mph
Bottom dump	optional

Mr. Kuehn is a mining engineer at Boise, Idaho. (3012 Innis St.)

USCOFLOW PLASTIC PIPE

New black UscoFlow Utility plastic pipe and fittings provide economical corrosion resistance—inside and out

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natural-gas lines **electrical conduit**

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WHAT'S NEW IN U.S. PATENTS

OLIVER S. NORTH

Exploration

Improved seismic prospecting device and method for producing earth vibrations by a plurality of explosive charges fired progressively as a single shot. Method is suitable for either refraction or reflection procedures. N.G. Johnson, G.A. Noddin and M.E. Swanson, assigned to E.I. du Pont de Nemours & Co. No. 2,823,609.

Construction of sampler for taking samples from holes of small bore, such as are made by a plug bit during test drilling for uranium. Sampler is lowered to desired depth in hole, and then a chisel-edged projectile is fired into wall to break off fragments, which are caught in a hollow section of the device. Old, abandoned holes may be advantageously re-sampled with this apparatus, for example, for a different type of mineralization. L.R.E. Cox. No. 2,825,533.

Mining

Improved arc-flame boring apparatus and method for drilling a shaft or hole to great vertical depths in the earth. Device is operative under water. Sidewalls of hole are reamed and stabilized through congealment of adjacent loose sand formations. Hole is continuously scavenged of rock particles as boring proceeds. R.W. Murray. No. 2,822,148.

Improved rock drill housing of the dust collecting type having simple and positive means for maintaining the drill steel chuck bearings free of drilling dust. Lubrication of bearings is easy, and lubricant will not become mixed with dust. T.A. Taylor, assigned to Westinghouse Air Brake Co. No. 2,827,170.

Drill steel centralizer having guiding ends shiftable into operative or inoperative positions by a remote control. Device is simple in construction and efficient in operation. R.P. Dellner, assigned to Westinghouse Air Brake Co. No. 2,828,109.

Rock drill carriage mounted on endless tracks, to permit travel over uneven ground. Weight of apparatus is distributed over entire lower surface of the tracks. J.H. Wagner, assigned to Ingersoll-Rand Co. No. 2,828,137.

Method for economical underground solution mining of trona, salt and other more or less soluble minerals. Bottom of a string of flexible steel pipe is deflected at a sharp angle to follow pitch of mineable stratum. Solvent is fed through nozzle as pipe is pushed downward from surface of ground. Probing nozzle can be advanced hundreds or thousands of feet. W.C. Brinton. No. 2,822,158.

Improved rock drilling machine for use in sinking a mine shaft. Mechanism is lowered into shaft and holes are drilled into walls thereof simultaneously and in any desired direction. C.K. Bain. No. 2,823,899.

Reamer for enlarging a vertical bore which is accessible at both ends, for example from one mine level to a lower open working. Spoil passes downward by gravity through unenlarged bore without clogging the hole. C.W. Kandle. No. 2,823,900.

Simple device used for facilitating insertion and packing of explosive cartridges in borehole. Charge is placed in a tubular member which is inserted into hole. When in position, cartridge is forced out by means of compressed air or vibration. C.H. Johansson, assigned to Nitroglycerin Aktiebolaget. No. 2,824,483.

Metal and Mineral Processing

Apparatus for concentrating gold or other heavy minerals. A.A. Johnston. No. 2,822,090.

Filter aid for alkali aluminate solutions. J.L. Martine Jr., assigned to Alcoa. No. 2,822,091.

Conditioning ores that are difficult to float. E.H. Snyder, Jr. No. 2,825,458.

COPIES of U.S. patents can be purchased at 25c each from Commissioner of Patents, Washington 25, D.C.

Apparatus for gravity concentration. G. W. Schuetz, assigned to Ore & Chemical Corp. No. 2,825,459.

Apparatus for heavy media separation. G.W. Schuetz and J.L. Kearns, assigned to Ore & Chemical Corp. No. 2,825,460.

Wet ore concentrator. R. Hackney and E.A. Carlson. No. 2,825,462.

Producing titanium by gaseous reduction of the halide salt. R.B. Eaton and C.H. Winter Jr., assigned to E.I. du Pont de Nemours & Co. No. 2,825,642.

Recovering platinum from perchlorate electrolyte. J.B. Heitman, assigned to Pennsalt Chemicals Corp. No. 2,825,643.

An improved magnetic separator. R.N. Palmer. No. 2,826,303.

Pulverizing mineral particles by means of an explosion produced with air or oxygen in a closed container. A. Haltmeier, assigned to Farbenfabriken Bayer. No. 2,826,369.

Moisture control of feed materials (wet or dry). D. Weston. No. 2,826,370.

Cooling and sealing arrangement for rotary kilns. O. Moklebust, assigned to National Lead Co. No. 2,826,403.

Separating uranium from copper in sulphate solution. F.A. Forward and J. Halpern, assigned to Canadian Patents & Development Ltd. No. 2,826,481.

Sintering iron ore fines. W.L. Davis Jr. assigned to U.S. Steel Corp. No. 2,826,487.

Production of high-purity titanium or zirconium by the alkali or alkali earth metal "torch method". G.R. Findlay, assigned to National Research Corp. No. 2,826,491.

Lightweight, portable ore separator. F. G. Graves. No. 2,827,170.

Separating germanium. M. De Merre, assigned to Societe Generale Metallurgique de Hoboken. No. 2,827,369.

Roasting zinc sulphide ores. B.O. Wilcox, No. 2,827,370.

Thermal process to improve gold recovery. J.W. Britton, assigned to Lakefield Research Ltd. No. 2,827,372.

Improved baths for electrolytic refining of lead. F.C. Smyers, G.B. Lantz and F. C. Mathers, assigned to U.S. Smelting & Refining Co. No. 2,827,410.

Dry mineral concentrator. R.G. Osborne Jr. and R.O. Boykin, assigned to Raymond G. Osborne Laboratories, Inc. No. 2,828,016.

Extracting vanadium from ores, etc. H.E. Dunn, B. Mayer and E.J. O'Brien, assigned to Vanadium Corp. of America. No. 2,822,240.

Process for the direct recovery of MnO_2. A.E. Bix. No. 2,822,243.

Pyrolytic reduction of fluorides to produce carbon-free metals. B.C. Raynes, assigned to Horizons Titanium Corp. No. 2,822,259.

Precipitating copper from ammoniacal nickel or nickel-cobalt solutions. V.N. Machiw, D.J.I. Evans and N. Yoshida (Sherritt Gordon). No. 2,822,261.

Separating small amounts of nickel from cobalt-containing solutions. R.L. Benoit, W.C. Lin and V.N. Mackiw, assigned to Sherritt Gordon Mines Ltd. No. 2,822,262.

Process for extracting copper from copper sulphide ores. F.A. Forward, assigned to Sherritt Gordon Mines Ltd. No. 2,822,263 .

Separating small amounts of nickel from cobalt-bearing solution. R.L. Benoit, and V.N. Machiw, assigned to Sherritt Gordon Mines Ltd. No. 2,822,264.

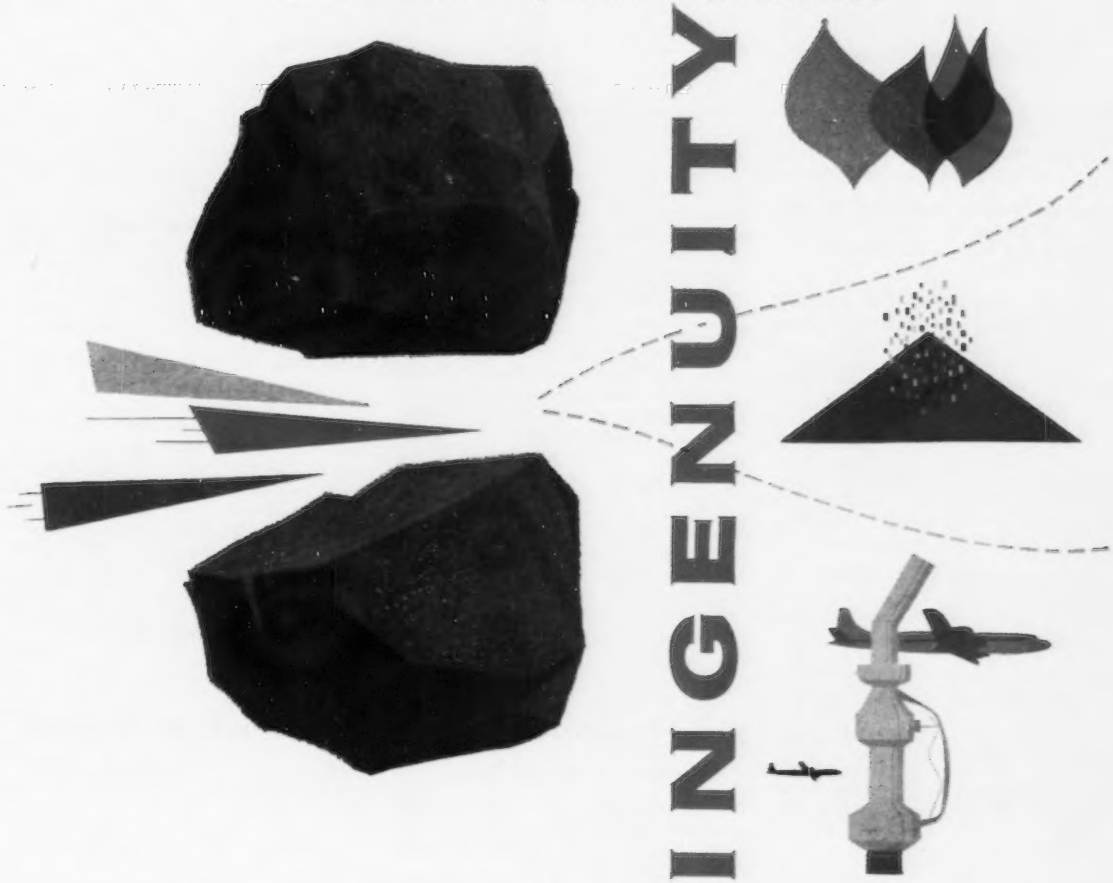
Recovering gallium from ores. L.K. Frevel and J.T. Cummer, assigned to Dow Chemical Co. No. 2,823,096.

Improvements in the Krupp direct reduction process for iron ore. R.H. Gerlach, assigned to Aktiengesellschaft fur Unternehmungen der Eisen-und Stahlindustrie. No. 2,823,108.

Production high-grade pig iron. K. Sudo, No. 2,823,109.

Mr. North is patent consultant, Washington, D. C.

call KE for plant expansion or new facilities



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U.S. PATENTS *(Continued)*

Metal and Mineral Processing

Producing metallic zinc by reduction of alkali metal zincate with hydrogen or water gas. W.H. Schechter, assigned to Callery Chemical Co. No. 2,823,110.

Continuous vacuum distillation of zinc. T.R.A. Davey and A.P. Newall, assigned to Broken Hill Associated Smelters Pty. Ltd. No. 2,823,111.

Composition for addition to standard fluxes for ferrous and nonferrous metal smelting. J.J. Miller. No. 2,823,112.

Apparatus for cooling sintered ores. W.C. Schofield and R.A. Powell, assigned to Koppers Co., Inc. No. 2,823,-912-3.

Electric furnace production of silicon. M.J. Udy, assigned to Strategic-Udy Metallurgical & Chemical Processes, Ltd. No. 2,823,983.

Smelting process for lead sulphides. J. Barwasser, W. Schwartz and H. Rausch assigned, to Metallgesellschaft Aktiengesellschaft. No. 2,823,990.

Flotation process for calcium-bearing minerals. M.N. Shaw. No. 2,824,643.

Dry crushing and grinding method. D. Weston. No. 2,824,700.

Heat transfer apparatus for calcined materials. A.C. Turney, S. Mitescu and B.J. Zubrzycki, assigned to F.L. Smidth & Co. No. 2,824,723.

Separating scandium and yttrium D.F. Peppard and E.S. Nachtman, assigned to U.S. AEC. No. 2,824,783.

Reduction of iron ore to metal. H.V. Rees and F.B. Sellers, assigned to Texaco Development Corp. No. 2,824,792.

Reducing iron ore. F.W. de Jahn, one-half assigned to Alan N. Mann. No. 2,824,793.

Method for operating fluidization reactor to reduce zinc ores or other zinciferous materials and produce a vapor rich in metallic zinc. Heavy particles are suspended in gas jets to prevent clogging of reactor bottom. J. H. Calbeck, H. B. Klimper and R. J. Mernitz, assigned to American Zinc, Lead & Smelting Co. No. 2,821,470.

In this process for reducing iron oxide ores, a part of the raw ore is passed first to a water-gas shift-conversion step to produce catalyst material therein, and then passed to a hydrogen reduction step. Method eliminates use of the usual expensive synthetic catalysts. F. B. Sellers, assigned to Texaco Development Corp. No. 2,821,471.

Method for purifying titanium and zirconium by removing therefrom oxygen and/or nitrogen contaminant. Impure metal is melted with excess carbon and subjected to electrolysis, whereby the metal is recovered at the cathode. E. Wainer, assigned to Horizons Titanium Corp. No. 2,821,506.

Preparation of titanium concentrates which are relatively poor in ferric iron and readily digestible in strong H_2SO_4. Certain proportions of soda ash or potassium carbonate are added during the dilute acid leaching operation. Titanium values remain insoluble, while silica and alumina enter solution. D. L. Armant and H. S. Sigurdson, assigned to National Lead Co. No. 2,815,272.

Economical process for recovering uranyl nitrate from aqueous solutions. A soluble nitrate salt of lithium, calcium, zinc or the like is added, and the solution extracted with a selective organic solvent, for example diethyl ether. N. H. Furman and R. J. Mundy, assigned to U. S. Atomic Energy Commission. No. 2,-816,005.

Recovery of nickel and cobalt from laterite ores. Ore is roasted with soda ash under oxidizing conditions and then leached with water to remove enough of the chromium content so that the residue may be subjected to selective reducing roast. Further leaching with water and carbon dioxide gas produces a solution containing nearly all of the nickel and cobalt values and a residue suitable for treating in a blast furnace to recover iron. J. W. Donaldson, assigned to Quebec Metallurgical Industries Ltd. No. 2,816,015.

Fractional distillation separation of plutonium from light elements, such as oxygen, lithium, beryllium, magnesium, etc. Plutonium is converted to the halide. B. Cunningham, assigned to U.S. Atomic Energy Commission. No. 2,816,813.

Separation of titanium values from euxenite or other ores containing columbium and tantalum in addition to titanium. Ore is treated with a substantially anhydrous hydrogen fluoride at elevated temperatures to volatilize titanium as its fluoride. After removal of titanium fluoride, columbium and tantalum fluorides can be volatilized and recovered, while any rare earth values present remain in the nonvolatile residue. J. R. Ruhoff, G. L. Martin and J. W. Pollock, assigned to Mallinckrodt Chemical Works. No. 2,816,815.

These Patents—17 Years Old—Have Now Expired

Patents of March 1941

Treating gold-silver ores with wetting agent prior to cyanidation. Falconer and Booth, assigned to American Cyanamid Co. No. 2,234,140.

Extracting gold from complex antimonial and arsenical ores. P.F. Loring. No. 2,-234,378.

Roasting or reducing copper ores. W.E. Greenawalt. No. 2,234,473.

Grinding mill discharge. Bird assigned to Battelle Institute. No. 2,235,757.

Wet recovery of gold from sands. L.S. Buskirk and P.R. Reid. No. 2,236,165.

Patents of April 1941

Recovery of alumina. Fink and de Marchi. No. 2,238,103.

Recovery of tin, bismuth, arsenic and antimony. Tainton. No. 2,238,194.

Production of soluble beryllium compounds. Adamoli. No. 2,238,206.

Purification of molybdenite. Curtis assigned to Miami Copper Co. No. 2,238,-250.

Recovery of indium. Zischkau assigned Asarco. No. 2,238,437.

Recovery of gold from black sands. Packard and Henricksen. No. 2,238,448.

Removing phosphorus from titanium-iron ores. Foerster. No. 2,238,586.

Floating fluorspar. Shepard assigned to Alcoa. No. 2,238,662.

Treating iron ores containing titanium and vanadium. Asak assigned to Christiania Spigerverk. No. 2,238,673.

Gold sluice. R.M. Mowry. No. 2,239,-396.

Recovery of copper and nickel from matte. Schlecht and Schlecht assigned to I.G. Farben. No. 2,239,626.

Patents of May 1941

Concentrating low-grade iron ores. Schiffman, Lawson and Blackmore. No. 2,240,718.

Recovering mineral from cyanide tails. Blomfield and Crocker assigned to Lake Shore Mines Ltd. No. 2,240,976.

Recovering indium. Zischkau and Linford assigned to Asarco. No. 2,241,438.

Recovery of beryllium. G. Jaeger and A. Rudert. No. 2,241,514.

Wetting agent for gold. K. Krebs and L. Tucker assigned to American Cyanamid Co. No. 2,241,605.

Leaching copper. A. Amenabar. No. 2,-242,217.

Chlorinating chromite. I.E. Muskat. No. 2,242,257.

Volatilization of silica. Zintl, Krings and Brauning. No. 2,242,497.

Madaras direct reduction of iron ore. J.D. Madaras. No. 2,243,110.

Chromite processing. M.J. Udy. No. 2,-243,785.

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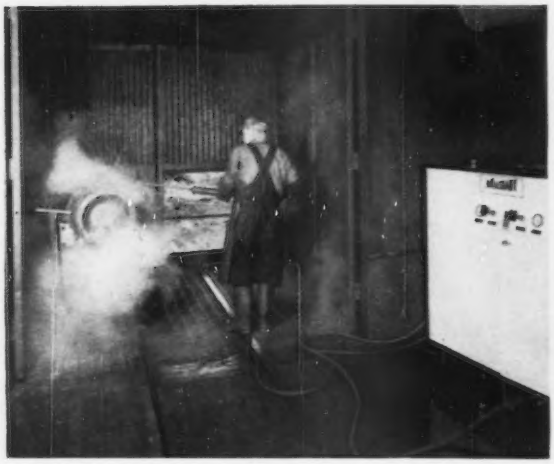


GRATING FLOOR, exhaust fans, large door and truck for equipment are features of cleaning room in surface mine-shop.

TRAILER-MOUNTED steam cleaner is self-contained, having water tanks and gasoline engine, for use in field at open pit.

Steam Cleaners Aid Maintenance in Iron Country

FASTER AND BETTER maintenance clean-up of mining equipment results from using versatile high-pressure steam cleaning units according to reports from a number of properties on the iron ranges.

One example of use on underground equipment is reported by John Ruona, mechanical engineer for Cleveland-Cliffs Iron Co., Ishpeming, Mich. He says:

"When equipment comes into our machine shop for regular repair and maintenance work, it is encrusted with mud, ore and grease. Most efficient method we know for cleaning off this coating is live steam under pressure. Our present steam room is equipped with two exhaust fans plus a large open doorway. Work is handled on two- or four-wheeled trucks. Floor is industrial grille type. Cleaner is fitted with steel casters to permit us to move it when necessary. Unit is arranged for 220v 3-phase power, and about three gallons of kerosene per hour are required for heating.

"Cleaning procedure on scraper hoists, for example, first involves blasting dirt layers off the outside. After this the nozzle is stuck inside to clean out grease in gear boxes. Then, following disassembly, components are steam cleaned individually. Such practice permits close inspection for flaws, breaks, cracks, wear, etc. Cleaning also removes dirt that might later interfere with any machining of parts that may be necessary.

"About one day is required to disassemble and clean approximately 75 parts in a scraper hoist."

Another example, at an open pit, is given by Peter Tarro, master mechanic at Mesabi Chief Mine, M. A. Hanna Co., Keewatin, Minn.:

"Our five steam cleaners reduce cleaning time on our iron-ore mining equipment by 75% and reduce total downtime by as much as 40%.

"One cleaner is a portable unit that is towed by tractor to machines in field that need cleaning but are not readily transported to repair shop. Purchased last spring, it is a special trailer-mounted unit. It carries two 150-gal water tanks—sufficient for 1½ to 1¾ hr of steam cleaning at 200 psi—for use when not near regular water sources. It has both gas engine and electric power outlets so it can be shop operated from regular power outlets or field operated with gas engine.

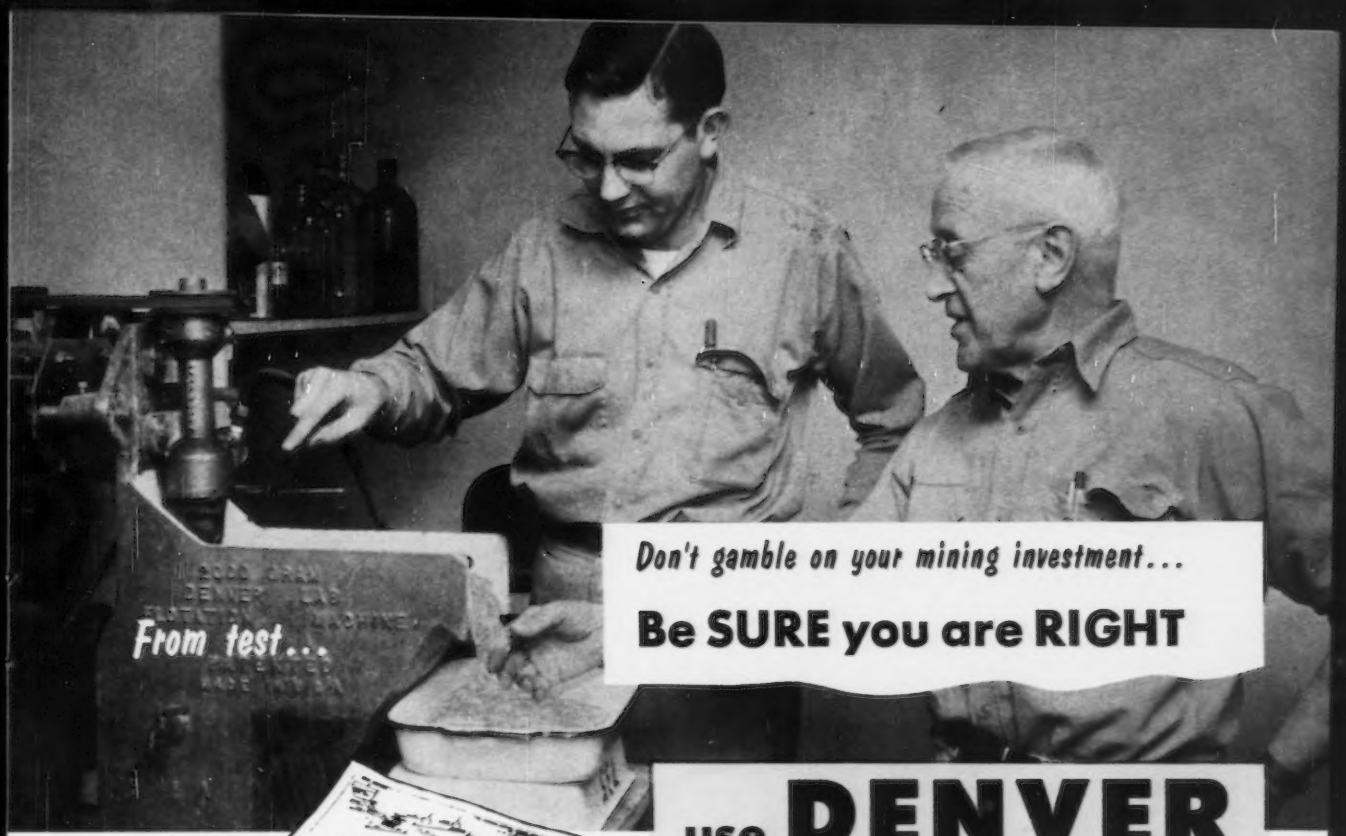
"At present we are overhauling a 6½-yd shovel in field. Because of steam cleaning right on site, we will reduce overhaul time to about five weeks as compared to the eight weeks that were necessary when we had to carry parts to stationary cleaners in repair shops.

"At our Mesabi Chief engine repair shop, where we repair about 300 engines a year from all Hanna mines in area, we have a stationary cleaner. Cleaning time per engine averages about one man-hour. Under old system of manual cleaning, it took two men about two hours, and even then the engines would never emerge as clean. Steam cleaning is only way to effectively prepare equipment for other repairs or a new paint job.

"At Carly, Perry and Mesabi Chief truck shops, it takes about five to six hours to thoroughly clean a tractor and about eight hours for a truck. Without the steam cleaners, in addition to using a water hose, the crew of two to four men would have to scrape off caked grease, mud and ore—and often be unable to reach many areas. But, with the old method we never spent more than one day on any truck or tractor, so of course the job was something less than thorough. Since we clean our fleet of trucks and tractors once a year, the more thoroughly clean, the better are the chances they will operate efficiently for a longer time.

"These stationary cleaners are used to clean such equipment as engines, transmissions, pistons, gears, shovels, compressors, graders, trucks, tractors, etc. We clean parts as the units are dismantled. After repairs are made we clean them again so that when equipment is put back into operation it is in best possible working condition."

Cleaner used at these and a number of other iron properties is a Model 250 high pressure combination made by Malsbury Mfg. Co., Oakland, Calif. Electric (1½-hp) driven, optionally oil or gas fired unit can deliver: 240 gph of solution at 300 psi and 325 deg F; 360 gph of cold rinse at 300 psi; or 15 bhp of wet steam for degassing tanks or general heating. Of course output is variable between these limits. Weight is about 1,000 lb. Gasoline engine drive can be furnished, too, for stationary, or caster or trailer movable models.



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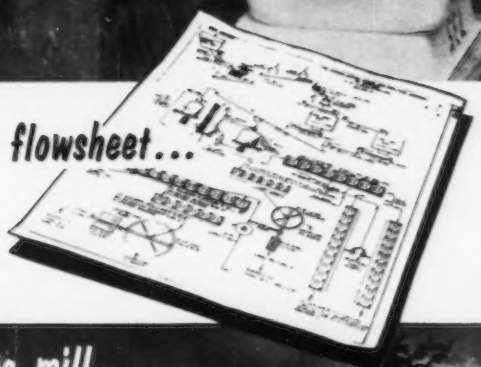

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DENVER Ore Test Service has an international reputation for accuracy and reliability—has long enjoyed the complete confidence of government bureaus, banks, consulting engineers and financial backers alike. It is a non-profit service available to you. Preliminary examination made without charge. Please send sample post-paid. Many Flowsheet Studies and Technical Bulletins are available on request. **Write for Bulletin**

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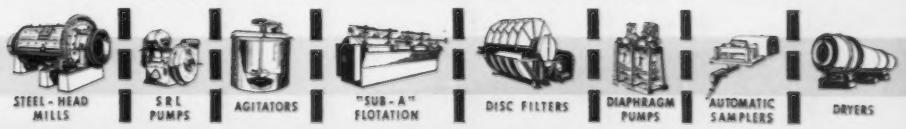
Complete Mill Equipment



OPERATING IDEAS *(Continued)*

Safety Stop Checks Incline Roll

AN EASILY BUILT SPRING-HINGED STOP that checks backward roll of underground mine cars has been installed at Hecla Mining Co.'s Radon mine near Moab, Utah.

The stop, normally straddling a rail at the crest of a 22% haulage incline, can be automatically swung aside when control cable is pulled.

Here's what happens. A locomotive rolls three cars against stop and then moves out of the way. Hoist rope is then hooked to the cars and they are pulled a few inches up the 22% slope to enable hoistman to open the stop. Cars are then lowered and the spring brings stop back to rail-straddling position.

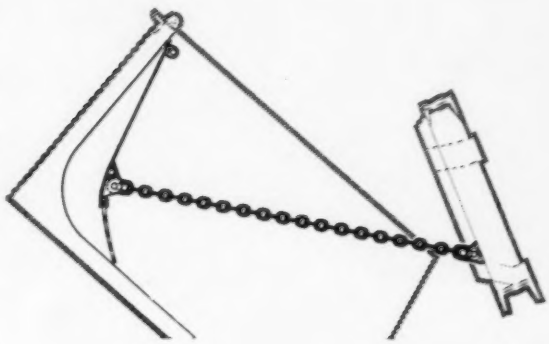
In the photo, man's foot is resting against the angled lower edge plate.

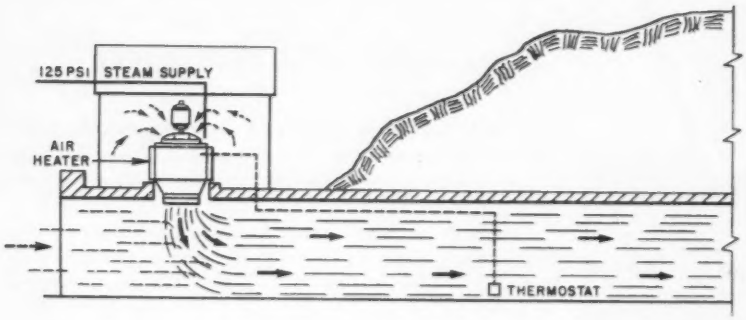
Extra Backplate Cleans Mine Car

FREE-SWINGING EXTRA BACKPLATES now solve the problem of car-clinging material at South Africa's Anglo-American Corp.'s Premier diamond mine.

The steel plate (5/16-in. thick and fitted on the bottom with a lip of 7-ply conveyor belting) is suspended from top of dump car backplate and attached to the door by short chains. When the car tips and door swings forward, plate is pulled 5 in. along car bottom and sets into motion any material which might otherwise have clung to the sides and floor of the 180 cubic ft capacity cars.

According to Anglo-American's magazine, Optima, not one car had to be cleaned manually at Premier mine during the last wet season.





Air Defrosts Tunnel

RAIL DAMAGE during sub-zero temperatures has been greatly reduced at a large western underground operation by installing a fresh air heater near tunnel entrance. The heater, a product of L. J. Wing Manufacturing Co., Linden, N. J., has coils heated by 125 psi steam and raises outside air to 40 deg F. A fan draws the warm air 1,200 ft into the tunnel at a rate of 30,000 cfm. Temperature is controlled by a throttle in the steam line at a downstream thermostat.

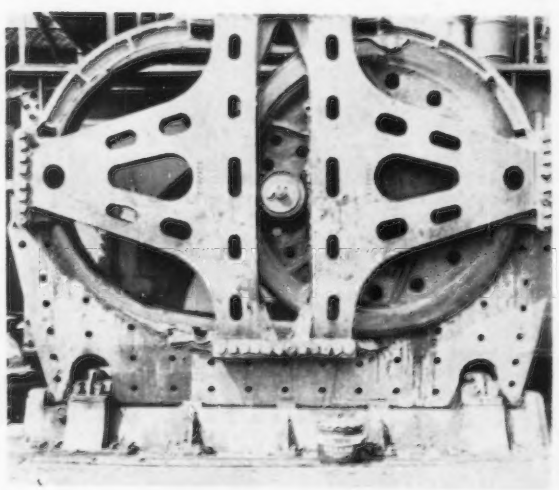
Walking Cam Grease Costs Cut

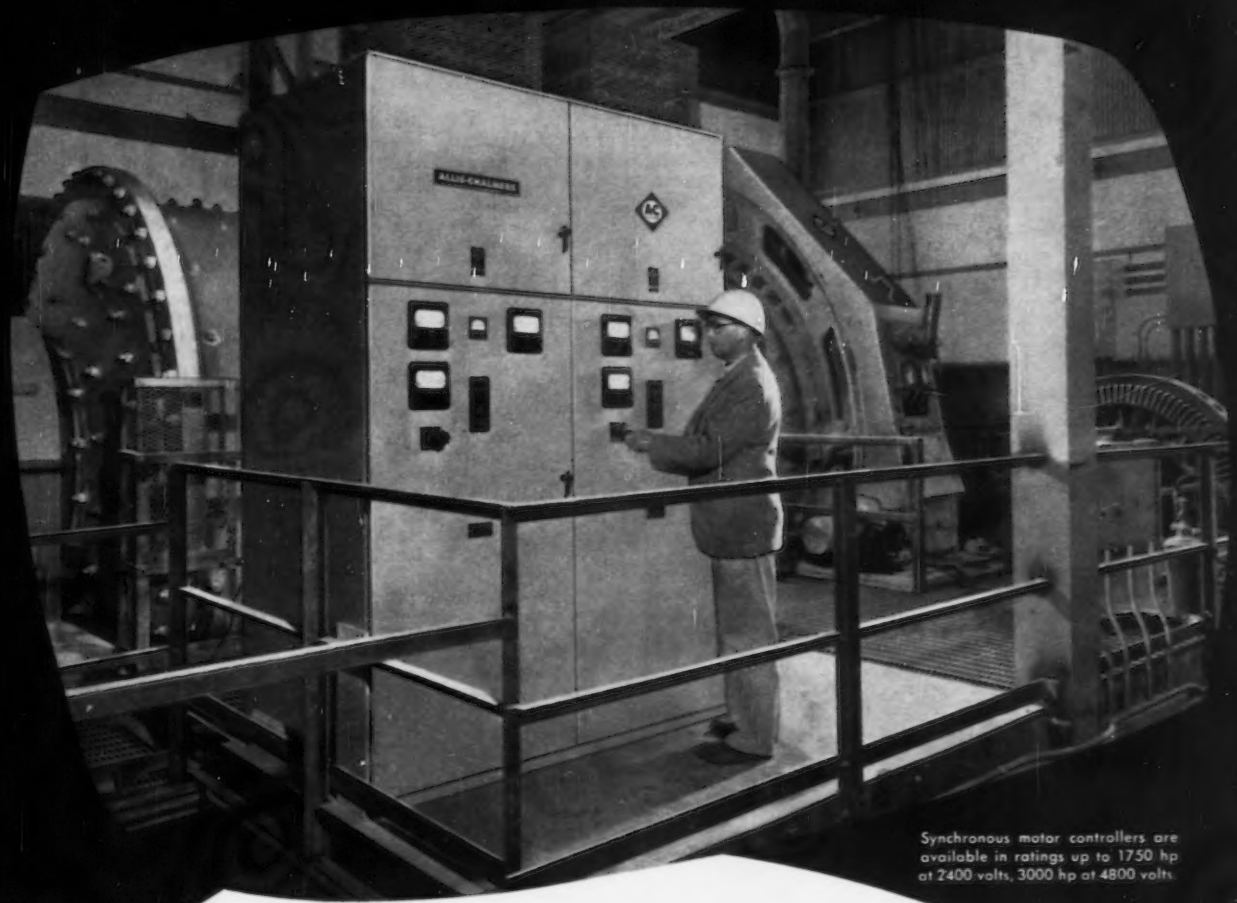
AT RECENT TESTS ON THE WALKING CAMS of a million-pound dragline, lubrication engineers found that a high-tenacity grease (Keystone No. 30B Heavy) improved cam lubrication and cut maintenance costs.

On one walking cam they put 10 lb of the grease they were then using. On the other, 10 lb of the Keystone variety. (Keystone Lubricating Co., Philadelphia).

The dragline mined for three days, moving as required. It then walked one-half mile to a new location. During the move, the cam with the conventional grease required the constant attention of one man who attemped to scoop up and re-apply the lubricant. In all, he applied 40 lb of additional grease to the cam. On the other cam, no additional grease was required, and the engineer estimated that there was still enough grease left for another one-quarter mile of travel.

Keystone claims that the high-film strength and other physical properties of its No. 30B Heavy enabled it to withstand the destructive action of high cam pressure, and, in addition to providing a longer-lasting protective film, they claim it came through with an 80% saving in lubrication consumption.





Synchronous motor controllers are available in ratings up to 1750 hp at 2400 volts, 3000 hp at 4800 volts.

Here's synchronous motor control matched to grinding mill requirements

DESIGN of proper control requires a knowledge of both motor and driven machine. Allis-Chalmers designs and builds both grinding mills and synchronous motors. Who, then, is in a better position to design control for grinding mill applications?

When you specify Allis-Chalmers, you can be sure the control circuit is designed to reduce costly down time. Mill-matching is the answer to difficult starting, acceleration, synchronization, and motor protection problems.

For more information about Allis-Chalmers synchronous motor control for any grinding mill application, call your nearby A-C office, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

Features

- Current limiting fuses clear short circuit in less than ½ cycle.
- Polarized automatic field application and field failure current relay provide complete field protection.
- Temperature compensated overload relay assures adequate stator protection.
- Instantaneous or time delay undervoltage protection available.
- Automatic inching available for quick, accurate, convenient spotting.
- Enclosures: NEMA 1 gasketed or NEMA 5 dust-tight.

ALLIS-CHALMERS

A-5763

PERSONALS

O. D. Niedermeyer has been appointed general manager of St. Louis Smelting & Refining Div. of National Lead Co.

Terry

Black

Lawrence F. Black, general superintendent of Geneva Works, has been named manager of Utah Operations for U.S. Steel's Columbia-Geneva Steel Division and manager of operations of the Columbia Iron Mining Co. Succeeding him in his former post is **A. E. Terry,** who, in turn, is succeeded by **Carl J. Forkum** as assistant general superintendent.

Hector Monette, in recent years manager of the associated Quebec Copper Corp., has been appointed manager of East Sullivan Mines, Que., succeeding the late **Herb J. LaRonde.**

H. Keith Conn, chief geologist in Canadian Johns-Manville's exploration department, was promoted recently to exploration manager.

Henry B. Somerset, chairman of directors, Australian Titan Products Pty. and a director of Electrolytic Zinc Co. of Australasia, has been elected president of Australasian Institute of Mining and Metallurgy.

The **Hon. Robert Winters** has been elected president, and **J. D. Head** general manager, of the newly formed company, Rio Tinto-Dow Ltd.

H. Vance Echols, formerly with Aluminium Co. of Canada Ltd., Montreal, has been appointed managing director of Indian Aluminium Co. Ltd., Calcutta.

Lloyd R. Johnson, formerly general superintendent at Lake Nordic Mine, Elliott Lake, Ont., is now general superintendent at Thompson, Man. for Patrick Harrison & Co., Ltd.

P. A. Lantz Jr., is now a surveyor on the staff of Algom Uranium Mines, Ltd., Elliott Lake, Ont.

R. J. Gray and **R. J. McAllister** have been appointed plant superintendent and assistant plant superintendent, respectively, of Consolidated Mining & Smelting Co. of Canada's furnace plants, smelting department. **S. G. Smillie** is now assistant plant superintendent, smelter services.

T. M. Gaetz, superintendent of mines, International Nickel Co. of Canada, has been promoted to manager of mines, succeeding **H. J. Mutz,** recently made assistant to general manager of Ontario Division. **Robert R. Saddington,** acting manager of reduction plants, has been promoted to manager of reduction plants. **John A. Pigott** succeeds Gaetz in his old position. **Clifford H. Stewart,** assistant mines superintendent, is now assistant to Gaetz.

J. J. Crowhurst has been named manager of Dawn Mining Co.'s operations at Ford, Wash., succeeding **R. B. Fulton.** Crowhurst was formerly manager for Granduc Mines Ltd. Fulton has been transferred to Newmont's New York office.

E. I. Renouard, manager of mines for Anaconda Co., Butte, has been appointed Montana state chairman during American Mining Congress's metal mining and industrial minerals convention-exposition in San Francisco. Frank Coolbaugh, vice president of Climax Molybdenum Co., is the national chairman of AMC.

Albert R. Cook has been appointed market development engineer for the American Zinc Institute.

Lute J. Parkinson, professor and head of the mining engineering department at the Colorado School of Mines, returned to Golden recently after a two-week stay at the University of Guanajuato. The Mexican school had invited Parkinson to consult with its mining faculty and advise its mining engineering curriculum; he also delivered a series of lectures during his visit. The trip was partially supported by the Colorado School of Mines Foundation, Inc., a private gift receiving corporation for Mines, a state-supported institution.

Parkinson

Charles A. Mitchell, Vancouver, has again taken over as secretary of the Mining Association of British Columbia. He resigned last year in order to organize the Sixth Commonwealth Mining Congress.

Charles H. Williams and **James B. Austin** have been appointed as administrative vice presidents, engineering, and research and technology, respectively, of U.S. Steel Corp.

Grover J. Duff retired Jan. 1 from the Eagle-Picher Co. after almost 25 years' service.

James C. Gray, R. M. Lloyd, and **M. D. Millard** were recently appointed to head up areas of their respective responsibilities as administrative vice presidents, in charge of raw materials, international and raw materials-staff, and international, of U.S. Steel Corp.

Phillip P. Powers, formerly with Andes Copper Mining Co., is now chief mine engineer for the Dulaney Mining Co., Grand Junction, Colo.

Benton Boyd, formerly superintendent, is now manager of U.S. Smelting Refining and Mining Co.'s U.S. and Lark Mine. **Max M. DuBois,** who had been assistant to the manager of mines, became assistant to the vice president and general manager of Western operations.

K. L. Allen was appointed assistant superintendent of mining at Cerro De Pasco Corp., Morococha, Peru.

Douglas R. Mabey has been appointed contract engineer for Kennecott Copper Corp.'s Utah Copper Div. He was formerly in the engineering department at Kennecott's Western Mining Division.

Raymond T. Whitzel recently retired as vice president and general production manager of Aluminum Co. of America. He has been succeeded by **Harold C. Erskine,** assistant production manager.

Roscoe H. Channing has retired as president and director of Hudson Bay Mining & Smelting Co. Ltd. and is succeeded by **C. V. Whitney,** board chairman.

Tom L. Pittman, formerly associated with Knob Hill Mines Inc., is now with the U.S. Bureau of Mines in Juneau, Alaska as mine examination and exploration engineer.

George W. Zeller, director of Polaris Mining Co., has been named to the board of Lucky Friday Silver-Lead Mines Co.

Augustus C. Long, chairman of Texas Co., has been named to the board of Freeport Sulphur Co.

L. H. Chalfant succeeds **T. J. Crocker,** who has retired, as manager of Bethlehem Mines Corp. **E. R. Luy,** superintendent of the Barbour-Randolph division, W. Va., replaces Chalfant as assistant general manager. **Henry R. Hall,** formerly superintendent of No. 44 mine, Idamay, W. Va., succeeds Luy.

Armand L. Labbe has joined the staff of the Industrial Fabrics division of Albany Felt Co., Albany, N. Y., as industrial consultant on problems concerning dust and smoke control and other phases of dry filtration. Mr. Labbe recently retired from his former position of metallurgist with the American Smelting & Refining Co., after serving with that firm for 45 years.

Labbe

M. S. Bell, former refinery superintendent of Phelps Dodge Corp.'s El Paso electrolytic copper refinery, has been promoted to plant superintendent.

Dr. Donald J. McPherson, former assistant manager of the metals department, has been appointed manager of the Metals Research department, Armour

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DELIVERS 150 TONS OF ORE PER HOUR!

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  Simple mechanical drive replaces complicated electrical system.
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  6', 12' or longer.
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  Grizzly and screen decks available for sizing, separating and dewatering. High-temperature units up to 2000°F.

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PERSONALS *(Continued)*

Research Foundation of the Illinois Institute of Technology, Chicago, succeeding **Robert A. Lubker,** who is now research director at Alan Wood Steel Co., Conshohocken, Pa.

John L. Douglas, manager of Joy Mfg. Co.'s El Paso office, **K. D. Loughridge,** assistant manager of Asarco's Southwest Div., and **Guy E. Ingersoll,** on Texas Western College's mining faculty, were recently elected chairman, vice president and secretary-treasurer, respectively, of AIME's El Paso, Texas section.

Stanley Walker has been appointed head of newly created managerial engineering department of Climax Molybdenum Co., Climax, Colo., and **Max Gelwix,** former planning engineer, will succeed Walker as chief of the department.

Dr. Walter R. Hibbard Jr., of Schenectady, N.Y., manager of Alloy Studies Research, General Electric Co.; **Dr. John Chipman,** professor of metallurgy, M.I.T.; **T. D. Jones,** American Smelting & Refining Co., Perth Amboy, N.J.; and **Robert W. Shearman,** of New York, were installed during the recent AIME national convention in New York City, as president, vice president, treasurer and secretary, respectively of the Metallurgical Society of AIME. Board members include **H. W. St. Clair, C. C. Long, C. S. Smith, J. B. Austin, J. S. Smart Jr., K. L. Fetters, H. B. Emerick, K. C. McCutcheon, H. K. Kellogg, W. J. Harris Jr., F. M. Hamilton.**

Dr. Eugene Willis Greenfield, of Spokane, has been named director of the division of Industrial Research at Washington State College's Institute of Technology at Pullman, Wash., effective June 1. Dr. Greenfield, who has been research supervisor of Kaiser Aluminum & Chemical Corp.'s metallurgical research department the past year, fills the vacancy left by the late **Dr. Raymond L. Albrook.**

Leonard G. Kanian, Virginia, Minn., and **Theodore U. Luthanen,** Ely, Minn., have received promotions at Oliver Iron Mining Div.'s eastern district, to district safety supervisor and safety engineer, respectively.

John H. Mathis, vice president and secretary of Lone Star Cement Corp., was recently elected a director of Inspiration Consolidated Copper Co. He fills vacancy caused by resignation of **Charles S. Sargent,** general partner of Hornblower & Weeks.

H. L. Fierman, John L. Kemmerer Jr., and **J. L. Mailman** have been elected directors of Consolidated Coppermines Corp., New York City.

James L. Marks Jr. has been appointed assistant to the administrative vice president, research and technology, of United States Steel Corp.

Dr. Robert Alan Huggins, assistant professor of metallurgy at Stanford University, has been named recipient of AIME's Robert Lansing Hardy Gold Medal for 1958 in recognition of promise in the field of metallurgy.

William L. Zeiher, and **Wayne L. Dalke** have been appointed by Oliver Iron Mining Div.'s Canisteo district, Coleraine, Minn. as assistant superintendent, Plummer mine, and general plant foreman, Arcturus Concentrator, respectively.

Charles Grosso has been appointed mine superintendent for National Potash Co.

Francis L. Pierson was promoted from senior geologist to chief geologist of United States Potash Co.

Dr. J. Donald Ryan, associate professor of geology at Lehigh University, was elected president of the Eastern section, Association of Geology Teachers, succeeding **Dr. Erling Dorf** of Princeton University. **Dr. Lincoln Dryden,** geology professor at Bryn Mawr College, was elected vice president. Renamed to office were: **Maurice B. Rosalski,** of City College of New York, secretary-treasurer; and **Dr. Lawrence Whitcomb,** of Lehigh, editor.

Henry K. Martin, formerly superintendent of concentration at Phelps Dodge Corp.'s Copper Queen Branch in Arizona, has been appointed to the newly created position of director of mineral development at Oglebay Norton Co. He had previously been with Oglebay Norton as development engineer on the taconite project of Reserve Mining Co.

David R. Straub, former vice president and general manager of White Pine Copper Co. and manager of Western Knapp Engineering Co.'s Chicago office, has recently been appointed manager, minerals division, of John F. Meissner Engineers, Inc., Chicago.

D. W. M. Ross is now president of Joy Manufacturing Co. (Canada) Ltd., succeeding **J. A. Drain,** who becomes board chairman. A Canadian-born and educated engineer, he has worked mining fields on two continents, acquiring a varied and comprehensive knowledge of mining techniques, and was instrumental in the formation of the Calgary Branch of CIMM.

Douglas E. Newton has recently been appointed to the post of product manager with Western Machinery Co., San Francisco, where he will specialize in applications involving flotation, classification, conditioning and other processing.

Charles J. Mylod, New York, has been elected a director of Butte Copper & Zinc Co., succeeding the late **Frank J. Gilbride.**

Correction: In the March issue, *E&MJ* inadvertently transposed the names under the photos of Messrs. Robinson and Mecia, of the Utah Construction Co.

OBITUARIES

Roy H. Glover, 67, Anaconda Co. board chairman, died Mar. 31 in Washington, D.C. of a heart attack. He had recently returned with Mrs. Glover from a State Department dinner given in honor of visiting Chilean Congress representatives. A graduate of the University of Oregon, and admitted to the Montana bar in 1918, Glover was a practicing lawyer until 1943. In 1942 he became counsel for the then Anaconda Copper Co.; in 1945 western general counsel, and vice president and general counsel in 1951. In May 1955 he was elected chairman. He was also director of 14 Anaconda subsidiary companies, and a director of the First National City Bank of New York and the First Bank Stock Co. of Minneapolis.

Glover

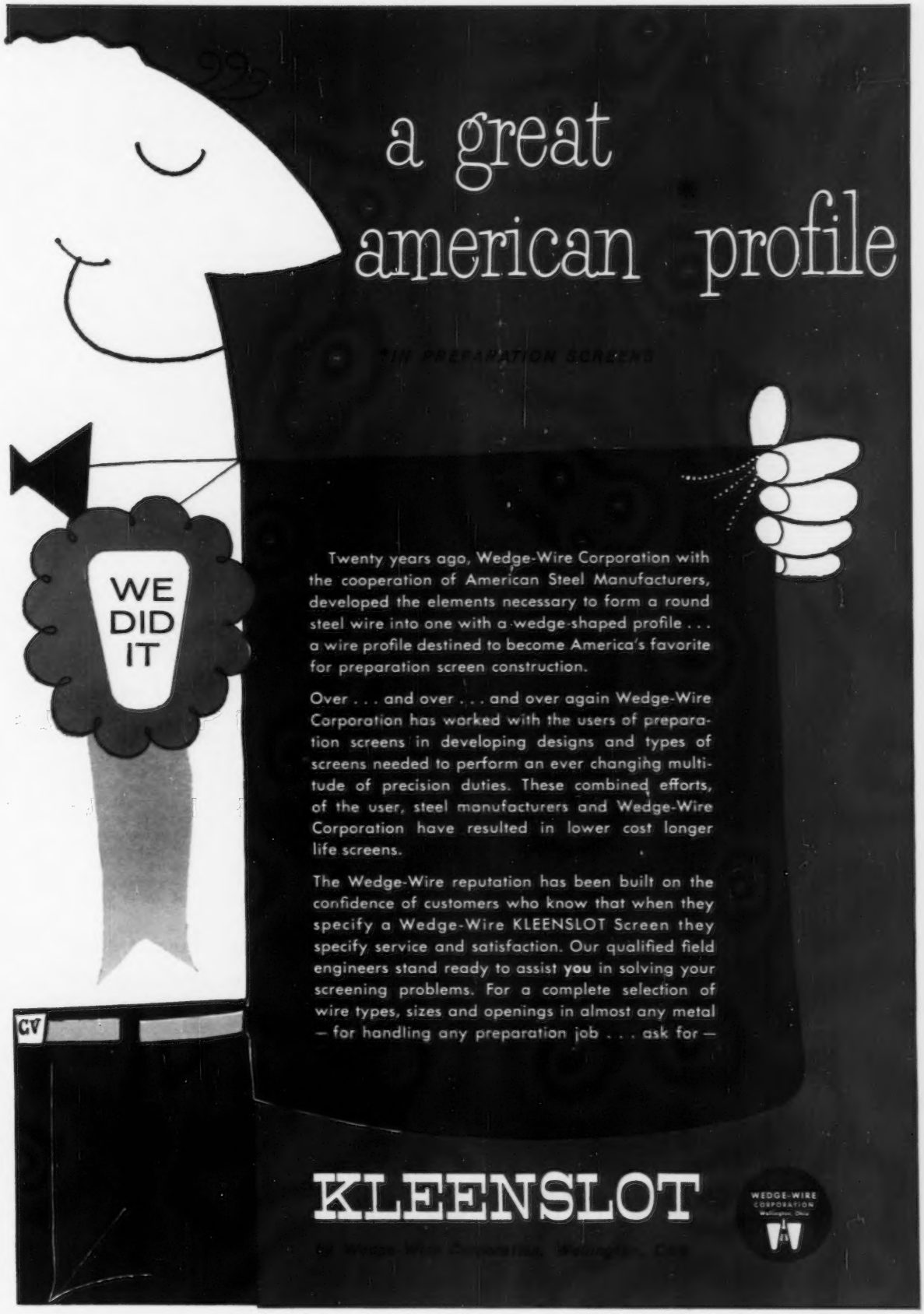
Glover was most proud of an award presented to him in 1955 when Carlos Ibanez del Campo, president of Chile, personally conferred on him the award of Knight Commander, Order of Merit of Bernardo O'Higgins, one of Chile's highest civilian awards. In 1955 United Press voted him Montana's Man of the Year. He lived at 280 Park Ave., New York City.

Fred O. Reedy, 66, president of Kennedy Van Saun Manufacturing & Engineering Corp., died of a heart attack, Feb. 24, in Danville, Pa.

W. J. Stratton, 91, who figured prominently in the early development of several mines in the Wallace, Idaho area, died in Spokane, Mar. 24. Stratton and his wife went into the business of financing mine exploration and development after Stratton had worked as accountant for mining companies in Wallace. Their first venture, Stratton Mines, resulted in a big ore strike on a prospect north of Wallace; they also financed initial work on an adjoining property. Both of these groups are now included in Day Mines Inc.'s Dayrock mine. Other companies they helped organize were the Silver Summit, Silver Dollar and Lincoln mining concerns, and founded the Hayden Hill Consolidated and Inspiration Lead.

Mark M. Mills, 40, leading atomic weapons designer and deputy director of the University of California's radiation laboratory at Livermore, died in a helicopter accident at the Eniwetok proving ground on April 7.

Robert C. Detchemendy, formerly of Flat River, Mo., and one time deputy state mine inspector, died in St. Louis Mar. 7.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AZI and Lead Industries Survey Markets Future

INDUSTRY FORECASTS, selling suggestions, and production-consumption reviews were recently featured at joint meetings of the American Zinc Institute and the Lead Industries Association, April 14-16, St. Louis, Mo.

During the first morning's session, R. C. Miller Jr. delivered his "Outlook for Galvanized Steel Sheets". Mr. Miller, assistant manager, Sheet Mill Production Division, Jones & Laughlin Steel Corp., said that both the short and long-term future of galvanized metals was excellent. "There is no question", he said, "that the new continuous galvanized line has supplied the consumer with a new steel product". As for the immediate future? "On the basis of projected levels of industrial production, construction and agricultural activities, shipments of galvanized sheets in 1960 should be 3.3-million tons, or 23.4% above the average of shipments in the past two years".

As part of his address, "Point of No Return", George F. Sullivan, editor of *The Iron Age*, stated that "we can spend ourselves blue in the face, but not until industry can afford to replace obsolete equipment with new cost-saving machinery can we expect a high level of industrial activity and employment."

The other AZI papers included: "Zinc Die Castings in Industrial Design" by Milton Immermann, partner, Walter Dorwin Teague Associates; AZI Annual Report given by Dr. C. C. Long, director of research, St. Joseph Lead Co. and chairman, AZI Technical Steering Comm.; Report of AZI Nominating Comm. for Directors, by Andrew Fletcher, committee chairman and president, St. Joseph Lead Co.; "Review of World Production and Consumption—Lead and Zinc" by Jean Vuillequez, vice president, American Metal Climax, Inc.; and "How Should We Promote and Sell Lead and Zinc?", S. D. Strauss, vice president, American Smelting and Refining Co.

John D. Bradley, president of the Bunker Hill Co., was elected president and board chairman of the Lead Industries Association. LIA sessions included reports from their Red Lead, Ceramics, Solder, and Industry Development Committees.

The AZI's slate of newly elected officers included;—as president, S. D. Strauss, vice president and manager of sales, Asarco—as executive vice president and secretary, J. L. Kimberley, New York—as vice presidents, J. D. Bradley, the Bunker Hill Co., San Francisco; Clarence Glass, Anaconda Sales Co., N.Y.C. and H. L. Long, American Zinc Sales Co., N.Y.C.

FABRICATED STAR BITS

The Fabricated Star Bit shown here has been designed especially for big hole drilling in hard formations. Far more efficient than the old style spudding bit and the big hole paddle-type bit, these Star Bits are custom-engineered to suit the particular hole size and the capacity of the drilling machine used.

Spang Fabricated Star Bits save labor and money. They can be quickly dressed to gauge, and speedily ready for drilling, by hard surfacing the cutting edge.

For drilling large diameter holes profitably

Here is a Fabricated Star Bit that has been successfully proven on numerous large hole projects. It is available in a wide range of diameters, and weights . . . the lengths in which they can be furnished are directly related to their overall weight.

Complete details and literature on request.

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Three Miners Expire in "Dead Air" Underground

AUTHORITIES are investigating the accident in Anaconda's closed Badger mine which claimed the lives of three veteran Butte Hill miners. The men were Timothy S. Hurley, 55, mine superintendent at Badger; Ernest Brisbin, 49 assistant foreman of the mine; and Joseph L. Shugert, 60, ventilation engineer.

The three men were investigating the Badger, which has been closed for several months, and apparently encountered a pocket of "dead air."

National Steel Delays Ontario Iron Ore Pit

A $20-MILLION iron ore open pit mine and ore treatment plant at Sudbury, Ont., will not go into production this summer as scheduled due to low ore demand.

The mine, owned by the National Steel Corp., has an estimated 3500-tpd potential for 25 years.

Alumina from Slates

A PILOT PLANT to extract alumina from aluminiferous slates was scheduled to go into operation this month at laboratories of the Ontario Department of Mines and Surveys. Plant will work on the ores of Canadian Alumina Corp., which holds a 28-square mile concession in Nova Scotia, and will use an acid leach.

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Wherever you have heavy loads, severe abrasion, that's the place for Yellow Strand "POWERSTEEL®!" Many users report 25% to 100% longer life than ordinary wire rope. "POWERSTEEL" is designed, manufactured and recommended for draglines – shovels – dozers. It spools freely, resists wear and crushing. Made from wire of the highest carbon content and tensile strength of any B & B Rope, "POWERSTEEL" is drawn to the most rigid specifications, is strong and tough.

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DIRECTORS WHO PLANNED Wyoming meeting included, left to right, R. W. Beamer, executive secretary; H. E. Potter; past president; P. R. Peterson; H. D. Hand, secretary-treasurer; R. L. Moran, and M. L. Sisson, of the program committee.

Wyoming Mining Plans for Growth

WYOMING MINING ASSOCIATION started its third year of organization with a mining convention at Casper, April 17-19. Born in a uranium boom of major importance, this new group has dedicated itself to the establishment of a favorable climate for mining ventures. Its members have worked painstakingly with the State legislature to formulate laws and tax policies that will permit the growth of an orderly and profitable mining industry. Endorsement of such aims was expressed by Gov. Milward L. Simpson, keynote speaker, who said that the State of Wyoming aims to establish "a proper economic climate for industry to move in."

Total mineral production for 1957 in Wyoming was valued at about $312-million, the Governor reported, of which about 80% constituted oil and gas production. The total did not include the value of uranium production.

High spots in the immediate outlook for the Wyoming mining industry as reported by various convention speakers included the following:

1. The U.S. Atomic Energy Commission has taken action in April to expand the limited extent of domestic uranium procurement which will increase domestic milling capacity by about 3,300 tpd. Of this total, AEC has estimated that Wyoming's share of increased mill capacity will be about 1,700 tpd.

2. A preliminary engineering contract has been awarded to Bechtel Corp. by U.S. Steel's Columbia-Geneva Steel division for the proposed $16-million taconite ore processing facility near Atlantic City.

3. Reynolds Mining Corp., subsidiary of Reynolds Metals Co., has exercised its option on 7,300 additional acres in the Lake DeSmet area including the lake itself. The property is adjacent to large coal deposits, and is being acquired as a potential power site for possible future expansion of Reynolds Metals Co.'s aluminum reduction facilities. No plans as yet have been made for construction of the plant, nor has any starting date been indicated.

4. Wyoming's bentonite reserves are the most extensive in the nation, and the industry looks forward to a substantial increase in the use of bentonite because its applications are so numerous. Gov. Simpson called it the "clay of a thousand uses."

Commenting on possible requirements of uranium for power plants, Dr. R. L. Doan, manager, atomic energy division, Phillips Petroleum Co., said that a 1-million-kw power plant might require 1,500 tons of uranium to start up, and burn about 15 tons per year. This amount of uranium per reactor would not place any great strain upon the domestic uranium output. In a paper on the same subject H. T Armstrong, the president of Wyoming Uranium Corp., noted that the first AEC boiling water reactor at Argonne National Laboratory was designed for 20,000 thermal kw, but it actually produced 50,000 kw. Developments under way indicate that costs can be reduced to 6 to 8 mills per kwh for reactors in the 100,000-to-200,000-kw range. Dr. Doan estimated that if costs can be brought down to 6 mills per kwh, at least half of the new power plants to be built in the future would be nuclear.

Cost-conscious operators will find a wealth of information in the transcripts to be made of two tape-recorded panel sessions which covered ore reserve evaluation, and open-pit methods.

Costs cited by the ore reserve evaluation panel for various exploratory drilling methods were as follows: Mud-coring with high-viscosity mud, $17.50 per ft cored; frozen cores obtained with diesel fuel as the coolant, $20 per ft cored, and $2 per ft of pre-cored cased or mudded hole; non-sampled holes drilled and probed, 50c to $1 per ft. It was reported that 90% of all reserves of uranium in the Wyoming area were based on gamma-log data. Members were warned of the possibility of drifting in deep drill holes. In the Ambrosia Lake area, drifting as much as 200 ft in a 500-ft hole was reported, and the average drift of holes in the same area was about 50 ft.

Users of gamma-logging equipment were advised to check the reliability of equipment used, i.e., the ability to repeat a reading for a given sample. It was also suggested that instruments be tested in calibration pits where the readings of the instruments could be checked against known concentrations of uranium in various horizons of the pit. The AEC maintains such a calibration pit at Grand Junction. In general, it was reported that scintillation counters give better results, but the cost of probing is higher.

The entire field or open-pit mining was covered by a 10-man panel. Types of mines discussed included bentonite, coal, iron ore and uranium. Comparison of methods used in various types of orebodies revealed interesting contrasts in problems. Discussion included the Rattlesnake pit in Utah where the stripping ratio was 78:1; the Sunrise iron-ore pit in Wyoming where the stripping ratio was 1:1; and coal mines where the stripping ratio varied from 20:1, to 1:1. This comprehensive session was tape-recorded for later transcription and distribution to members of the Wyoming Mining Association and guests.

Newly elected officers of the Wyoming Mining Association are Glenn Sorenson, president; M. L. Sisson, vice-president; and H. D. Hand, secretary-treasurer.

NOVEL METHOD used to mine "Red Dog"

1½-cu. yd. Case TerraTrac tractor-shovel quickly loads out "red dog", dozed off mountain top by TerraTrac "1000" angledozer (see right). Precision-control and close-quarter maneuverability are doubly important here.

Roy Chaney and Ishmael Everidge, Neon, Kentucky excavating contractors, have developed a novel way of supplying "red dog"* fill for muddy spots in Kentucky mountain roads. Chaney takes his 100 HP Case® TerraTrac® Model 1000 power-angling dozer up on *top of the mountain,* and dozes fill material over the side of the cliff. *Several hundred feet below,* Everidge loads it into trucks with a 1½-cu. yd. TerraTrac "800" tractor-shovel.

Exclusive features pay off

A veteran operator, with *14 years' experience* on all makes of crawlers, Roy Chaney says, "These new TerraTracs *have 'em all beat* for getting jobs done *fast, with* minimum operator effort. They're as sure-footed as mountain goats, and will practically go up a tree." Chaney especially likes TerraTrac's *smooth, steady power and positive foot-accelerator control.* With torque-converter drive, he has an infinite number of forward working speeds — from 0 to 6.0 MPH — automatically balanced to changing loads — so he can work right up to the edge of a cliff — *without danger of stalling.*

TerraTrac's exclusive power-shift transmission also lets him shift from forward to reverse INSTANTLY — with the flick of a wrist — without clutching, or hazardous hesitation. In addition, the ability to change dozer blade-angle *hydraulically* — from the operator's seat — is a big advantage in breaking out hard material and clearing slides on narrow mountain trails.

Novice and expert agree

Chaney's partner, Ishmael Everidge, readily admits — "I'm really not a tractor operator, but this TerraTrac '800' is so simple and easy to run that I can load trucks *like a veteran.*" With the constant-mesh Terramatic transmission, he has no problem of gear-clashing or learning to shift . . . and since each track is *independently* powered, he can spin-turn the TerraTrac *within its own track length* for extra-sharp turns in tight spots. "We would have had to make our roadway and loading shelf *at least 15 feet wider, if we had bought any other crawler,"* says Everidge. To which Chaney adds, "We're so well pleased with both the '800' and '1000' we plan to buy more!"

Worth looking into

You may not have the problem of getting "red dog" down a mountain — but if you move dirt, rock, shale, or what-not, you'll find Case TerraTrac's *advanced* performance features can mean the difference between profit and loss on your jobs. See for yourself! Visit your Case Industrial Dealer and arrange for a demonstration *on your job — soon.* Or, mail coupon for free literature on sizes in which you are interested.

*"Red Dog" is burned slate and rock — excellent for highway fill.

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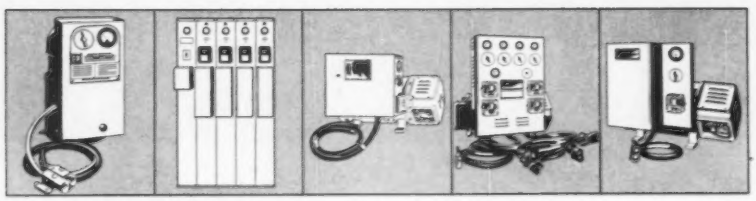

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Write for complete technical details and prices. Exide Industrial Division, The Electric Storage Battery Company, Philadelphia 2, Pa.

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IN THE U.S.

ARIZONA

Metate Asbestos Corp. has started construction of an asbestos processing plant on its property east of Globe. The $50,000 operation will include a 5-unit mill for filtration fibers for the building trades.

When the plant is finished, Metate will move its crude mill from Bear Canyon and run it in conjunction with the low-grade mill. Over-all cost is estimated at $150,000.

A huge low grade copper orebody amenable to open pit mining has been delineated in the Mineral Hill-Daisy area of the Pima Mining District southwest of Tucson, Banner Mining Co. advised shareholders in annual report.

"The results of company drilling have been exceptionally encouraging and we have substantially exposed the size of the low-grade orebodies reported last year," said E. S. Bowman, Banner president, in the shareholders report.

"Further drilling is certainly warranted in order to evaluate our holdings in this area," Bowman said.

Option to buy the controlling interest in Bagdad Copper Corp. for an amount in excess of $27-million has been given to Griffith Annesley, Beverly Hills, Calif.

John C. Lincoln, Bagdad president, said the sale negotiations have been under way for several years. The option given Annesley expires July 1. The Lincoln family holds 52% of the firm's stock.

Annesley will have to line up a buyer for the Bagdad.

Company's annual report showed an operating loss for 1957, despite increased output. Loss was credited to surface stripping in advance of coming operations which exposed an estimated 3-year supply of ore; and because of copper price declines.

CALIFORNIA

An abandoned gold mine in the Santa Lucia mountains 80 miles south of Monterey has been reopened by James B. Pauley and Gerald A. Doyle, Watsonville, who acquired a lease on the property from Art Sherman and Archie Hammond, Pacific Grove.

The mine, now called the Ancona, was once known as the Brewery Mine and dates back to 1887.

Sinking a new shaft to the main tunnel, the new operators of the mine uncovered a long vein of quartz that assayed 76.86 oz Au and 6.80 oz Ag per ton. Sixty feet of the 3-ft wide vein have been exposed.

The remaining ore—aside from the high-grade quartz—will average about $60 a ton, the operators expect. Chip assay taken at intersection of the shaft and tunnel showed 1.66 oz Au per ton.

Pauley and Doyle got into the workings (blocked by slides) by sinking a

129 MILLION YARDS —and this YUBA DREDGE is still going strong

Yuba Dredge No. 94 digs to 112' below water level with 18 cu. ft. buckets. Among the 175 California type placer mining dredges built by Yuba, some have digging depths to 120'.

In over half a century of dredge design and construction, Yuba has built more California type placer mining dredges than any other manufacturer. Successful operation on every continent gives daily proof of the ruggedness, advanced engineering, and practical experience built into every Yuba Dredge. Sectional pontoon hulls and unitized construction simplify disassembly for easy relocation by ship, train, plane or truck. Minimum downtime is assured by such exclusive features as the Yuba designed seal which protects underwater bearings. For the most productive dredges and parts – bucket ladder, suction or clamshell – and for specialized mining equipment – contact Yuba Mining Division today.

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Proved for profitable gravity separation at lowest maintenance. Yuba Jigs feature fully enclosed drive mechanism, side diaphragm operation, positive action over entire bed, adjustable speed and stroke, and easily changeable screens. This adds up to maximum recovery under all operating conditions. Ideal for concentrating gold, iron, cassiterite, sapphires, diamonds, and a wide range of other ores – or special sand and gravel cleaning. Investigate these compact high production Yuba Jigs for new or old dredges or plants. Let Yuba specialists know your operating problems.

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Now 2000 feet long from face to portal, this Barber-Greene conveyor has already been extended several times. And it will be lengthened many more times before the deposit is worked out. The easy lengthening of Barber-Greene underground mine conveyors is just one of the many advantages of Barber-Greene standardization.

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Faster delivery. Packaged units come from dealer stock or are immediately available from the factory.

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Parts availability. Repair parts can be shipped from stock—usually from the local distributor's stock.

Literature on request.

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CONVEYORS . . . LOADERS . . . DITCHERS . . . ASPHALT PAVING EQUIPMENT

California *(Continued)*

6x8-ft shaft through the slide, dropping rock down the shaft to a chute at the tunnel level. They cleaned and timbered the crosscut and left wing, which had been backfilled. They secured the winze in the main tunnel (which is several hundred feet long) by driving 200 ft of iron through the slide east of the shaft, then forcing 3-in. logging under the iron strips.

They are installing a 5-ton ball mill. After grinding to 30 mesh the ore will be concentrated on a corduroy table. Free gold will be shipped to the mint, and the remainder will be custom smelted.

Headframe and hoisting equipment is being installed now. The operators plan to continue crosscuts and drifting, then sink the shaft another 100 ft to establish a second level.

Bunker Hill Co. announced an estimated earnings loss for the first quarter of 1958, "as a result of excessive foreign imports and their effect on domestic lead-zinc prices and sales."

Bunker Hill's president John Bradley said that any improvement in metal prices in the near term is dependent upon Governmental action. He said this could be in the form of realistic tariff protection, limiting imports to our requirements, or removal of the restriction on the barter program. However, he said that termination of buying for the U.S. stock pile, expected in the near future, might tend to offset these beneficial factors.

"We recognize the benefits of a healthy and active Free World trade program," Bradley said, "but we are strongly opposed to trade activities which result in such excessive imports to our country that our domestic industries and working forces are sacrificed."

Wallace G. Woolf, vice president of Kellogg operations, reported that in 1957 the company had the highest production of lead metals and zinc-in-fume in the 40-year operation of the lead smelter. He also reported a new high record output of zinc, cadmium metals and sulphuric acid at the electrolytic zinc plant. He added that the profitability resulting from the operation of the newly constructed fifth unit had exceeded estimations.

Harold E. Lee, vice president in charge of research and development, reported that company research in the barium chemical field had resulted in a 25% participation with the Sherwin-Williams Co. in a barium hydrate plant now being constructed at Coffeyville, Kansas. Lee said that this chemical had a growing usage as an additive to lubricants.

COLORADO

Mineral Concentrates, Inc., announced it will begin construction immediately of a beryllium processing plant at Loveland, 50 miles north of Denver.

The plant, estimated to cost $250,000, is scheduled for operation in June, L. Bernard Davis, firm president, said.

He said the plant will produce beryl-

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motor graders

keeps haul roads clear for payloads

Earth rolls off the moldboard as the Huber-Warco MOTOR GRADER quickly and efficiently performs its grading assignment. Huber-Warco MOTOR GRADERS with torque converter, tail-shaft governor and power-shift transmission make faster passes with smoother cuts . . . gives more profitable grader operation. Once the operator sets the desired speed it is maintained by the tail-shaft governor, regardless of load conditions. Operators also like the easy maneuverability and the fact that there is NO CLUTCH in the torque converter models provides a new ease of operation. An exclusive feature of Huber-Warco MOTOR GRADERS is the completely cab-controlled hydraulic blade movement for bank sloping. In less than a minute, and without ever leaving the cab, the operator can move the blade from a 90° bank sloping position on one side to 90° on the other. There are NO manual adjustments to be made. Huber-Warco torque converter and standard transmission MOTOR GRADERS range from 75 to 195 h.p. See your Huber-Warco distributor for complete details.

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NEW JOY JSL-7 Shovel Loaders

built to Your specifications

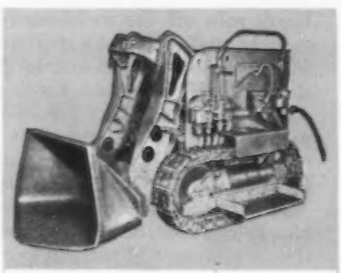
The all-new Joy overhead discharge JSL-7 Shovel Loader with forged rollers, shoes and links has independently-controlled crawlers—controls positioned where *you* want them—and choice of Pistonair air motors or electric power.

If the models tabulated at right won't fit your work . . . tell the Joy Engineer what you want the JSL-7 to do and we'll build to your job specifications.

In addition to the standard JSL-7, you can choose special bucket designs, grousers, 'dozer attachments and other equipment. We'll build Joy Shovel Loaders with special arms and counterweights for mucking on grades greater than 9° uphill or 15° downhill; bucket discharge heights to 87" if required.

Write today for details on this crawler-mounted loader that delivers 12,080 lbs. crowding effort at the bucket lip. ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Company (Canada), Limited, Galt, Ontario.*

Above: JSL-7 Shovel Loader, electric model, loading into Joy Rock Shuttle Car in Midwest metal mine. Below: Air motor model JSL-7 Loader.



JOY JSL-7 Loader	Specs
Height, minimum..... Headroom Range.....	60" 81" to 114"
Width, overall..... w/platform.....	57½" 69"
Length, with bucket in digging position....	112½"
Weight, Air..... Electric.....	9,650 lbs. 11,250 lbs.
Loading, average.....	2—4 tpm

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Drillmobiles

Colorado *(Continued)*

lium hydroxide from beryl ore to be mined in the Crystal Mountain area about 35 miles northwest of Loveland.

Davis said he was advised that five companies are planning to mine beryl in the district. He identified them as Allphin Mining Co., Consolidated Gold-Uranium Corp., Keystone Beryllium Corp., American Beryllium Corp., and Sterling Beryllium and Oil Corp.

The plant will include facilities to separate mica, usually found with beryl ores.

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Pushing its preliminary work prior to applying for a uranium processing mill to handle ore from its Tallahassee-South Park area in southern Colorado, United Western Minerals Co. has drilled several thousand feet of exploration holes during the past two months. From the standpoint of the company, the drilling efforts have been highly successful, and approximately 40,000 tons of proven ore and 120,000 tons of inferred ore have been indicated.

Drilling is being done under supervision of Marvin C. Chase, former district geologist for the AEC, and now in charge of United Western's Colorado operations.

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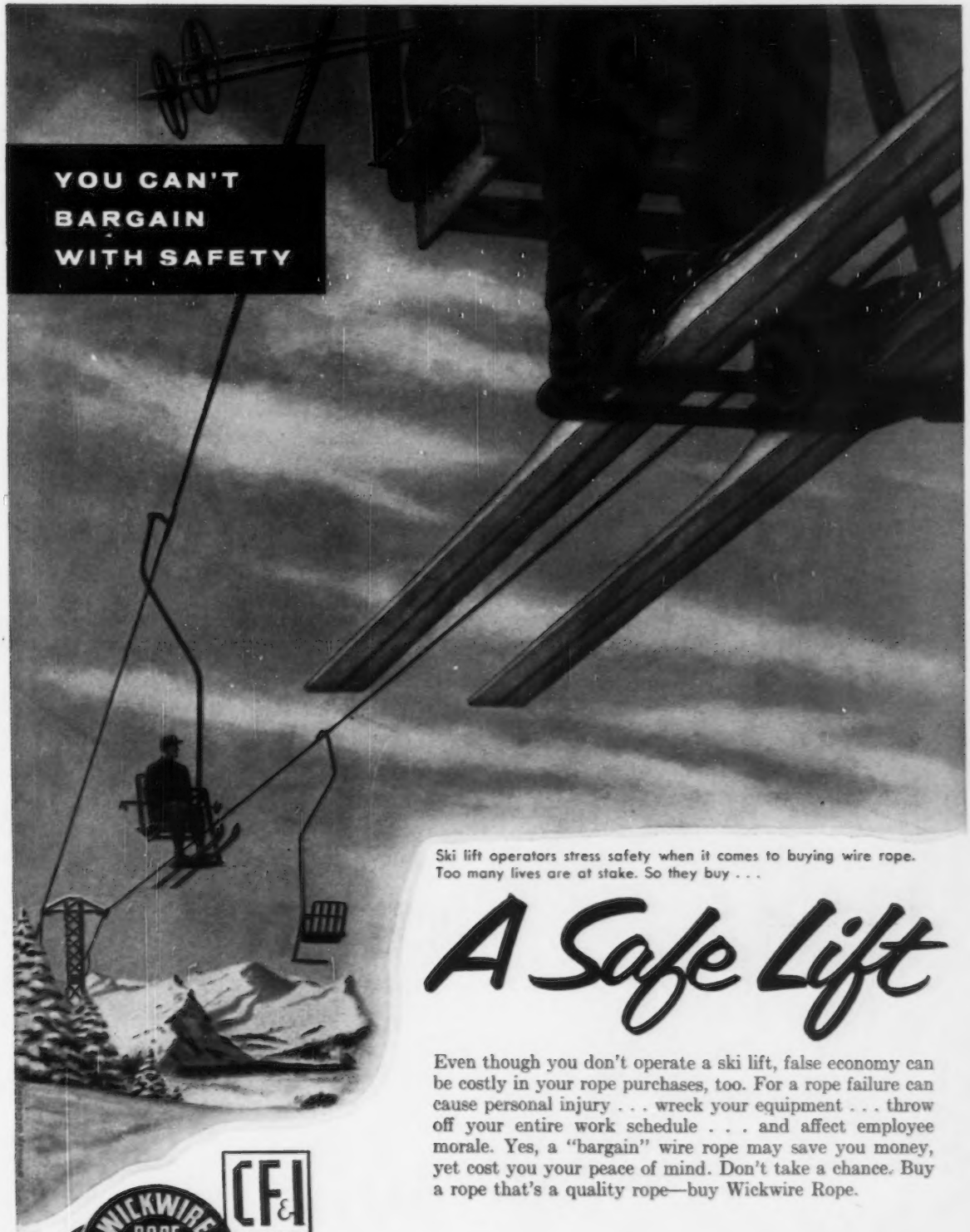

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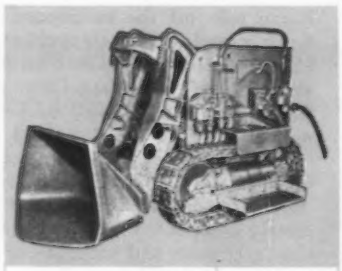

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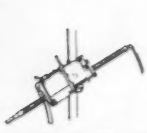

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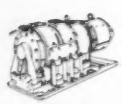

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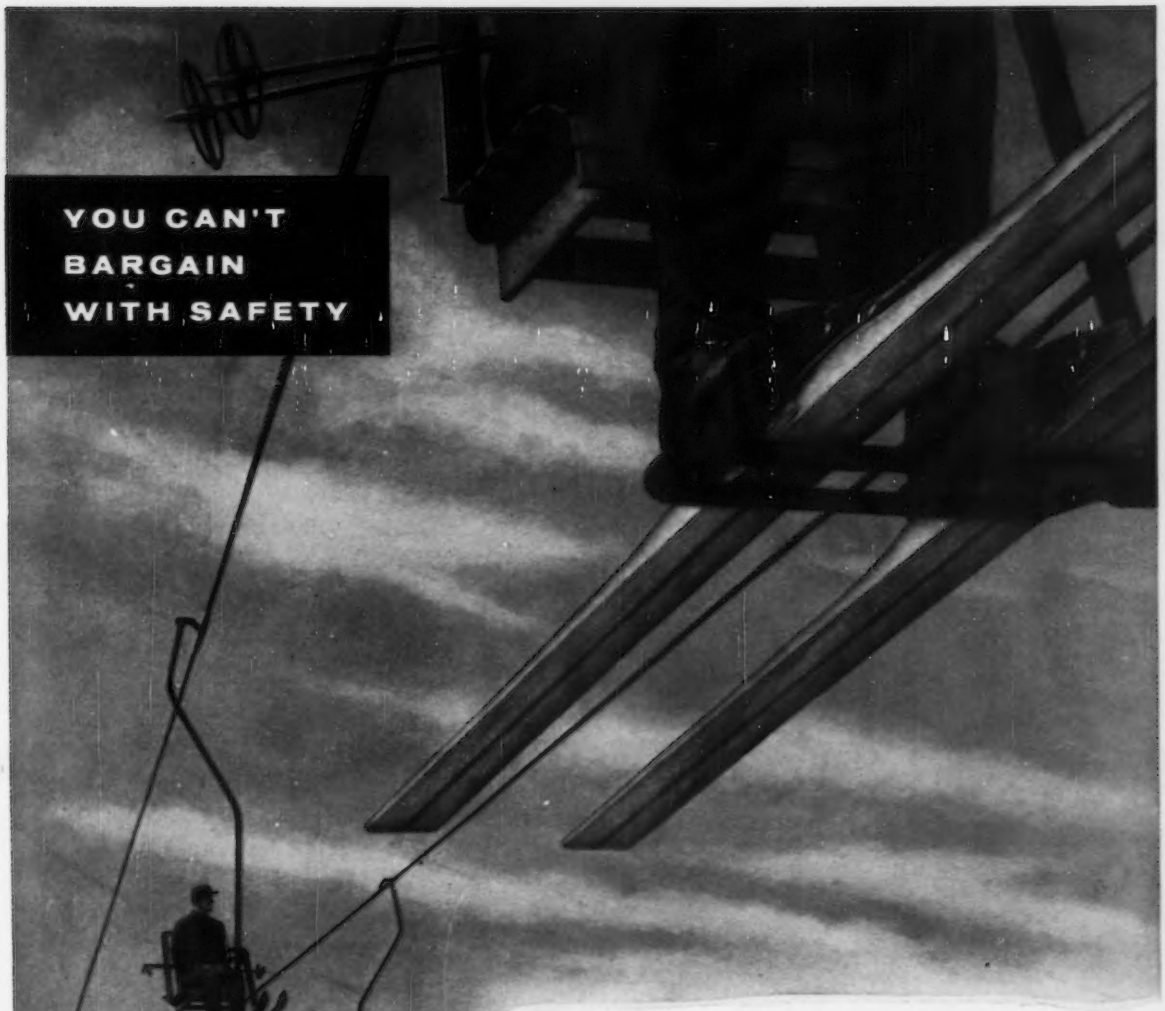

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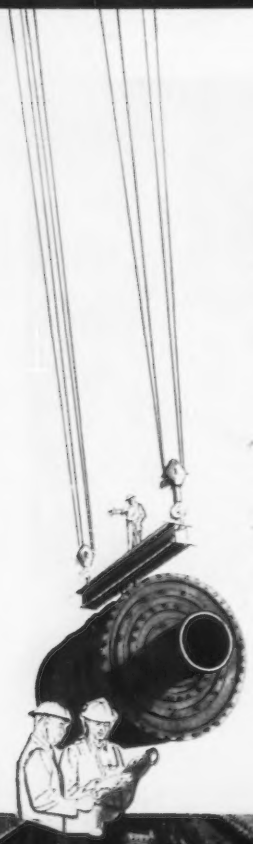


3 reasons why you should specify NORDBERG GRINDING MILLS

1. Advanced Engineering

Nordberg mill design reflects significant technological improvements that may measurably affect your installation and operating costs. Sealed trunnion bearings; positive bearing lubrication; optimum life of wearing parts are among the features that will benefit you.

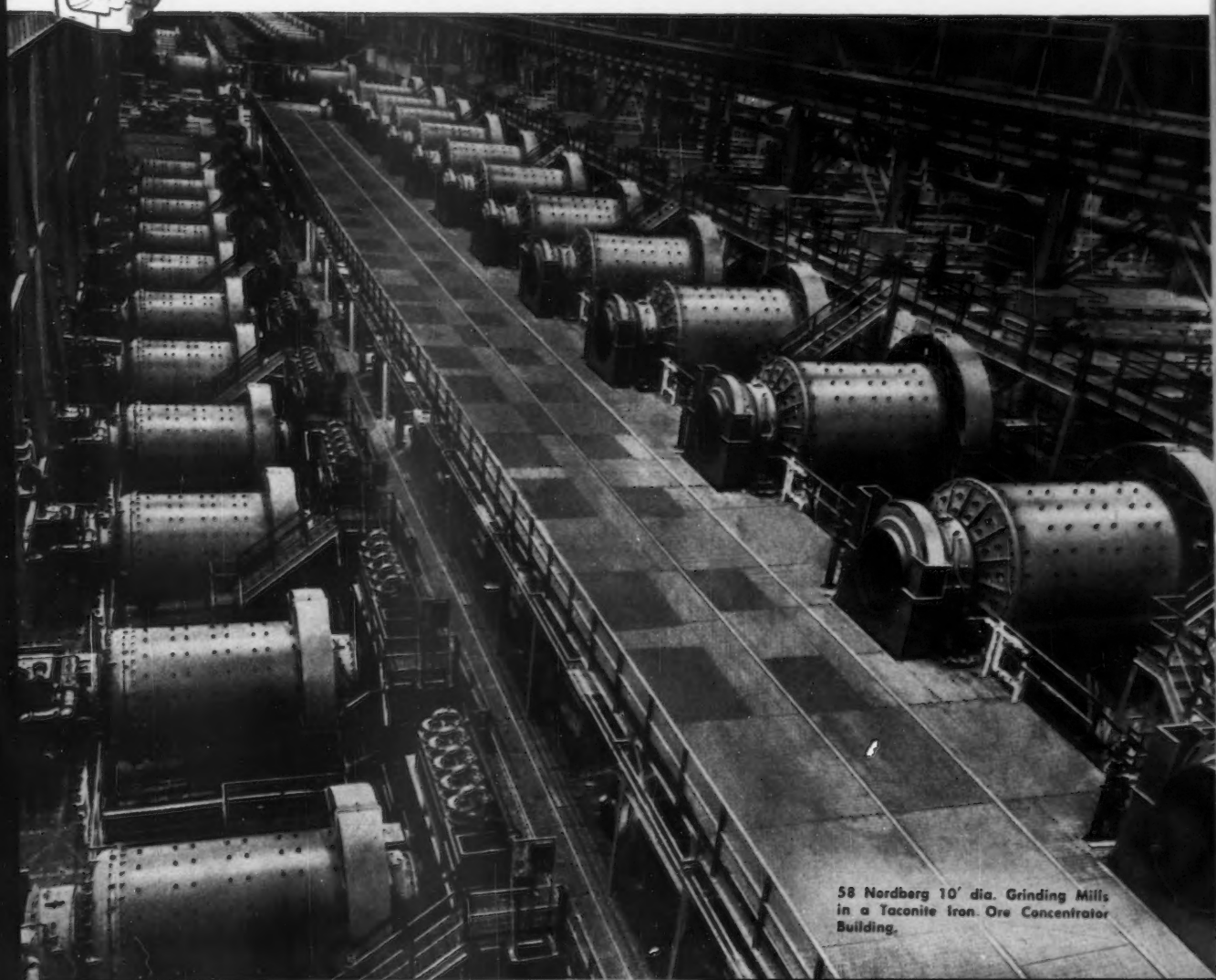
2. Quality Manufacture

Nordberg Mills are (1) precision built to rigid specifications in shops renowned for (2) skilled manufacturing personnel, and (3) modern machine tools and equipment to assure quality workmanship. Good reason why the name *NORDBERG* has always signified the *ultimate* in mining, quarrying and process machinery.

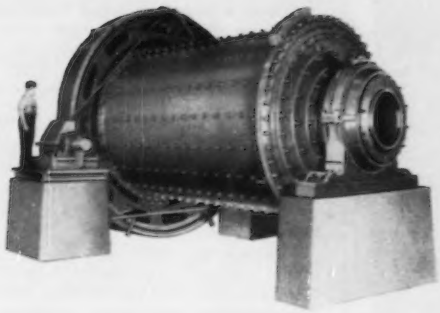
3. Dependable Operation

A team of experienced application engineers with a sound understanding of your milling operations qualifies Nordberg to serve you. More important, it assures you of the right machinery for the job . . . machinery that must be dependable and will continually produce to your specifications.

Nordberg Grinding Mills are built to meet specified conditions for wet or dry grinding—in the manufacture of cement; the fine reduction of metallic and non-metallic minerals; and in numerous other processes where friable material must be comminuted to fine sizes at low cost per ton. They are available with grate, overflow or peripheral discharge . . . and are built in sizes from 6 feet to 13 feet in diameter and up to 50 feet in length.

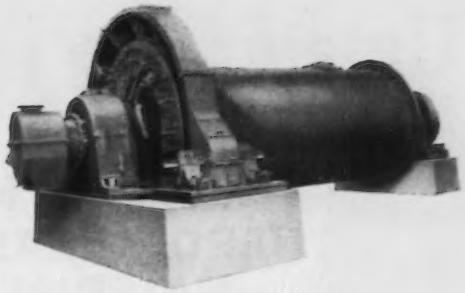


58 Nordberg 10′ dia. Grinding Mills in a Taconite Iron Ore Concentrator Building.



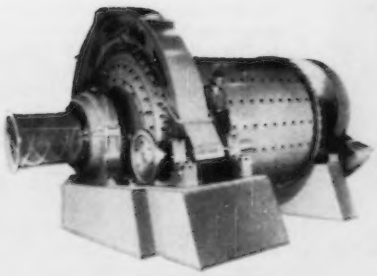
ROD MILLS

For the coarser or primary grinding stages of milling plants.



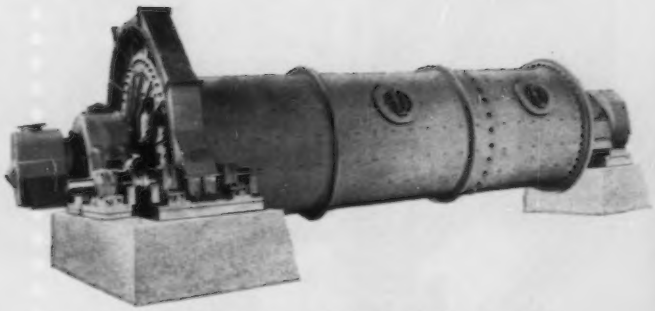
TUBE MILLS

These Nordberg units are used primarily where extremely fine grinding is required.



BALL MILLS

Having principal application in the fine grinding of ores, and minerals, and as preliminary mills operating in tandem or series with tube or compartment mills.



COMPARTMENT MILLS

For multi-stage grinding to ultra-fine specifications, these Nordberg Mills are built in lengths to 50 ft., with two, three, or more compartments.

BULLETIN 232 covers the complete line of Nordberg Grinding Mills for efficient, low cost processing of ores and industrial minerals. Write for a copy today.

BULLETIN 263 describes the advantages of using Nordberg "NI-HARD" for mill liners and other machinery components subject to rapid abrasive wear. Copy on request.

NORDBERG MFG. CO., Milwaukee 1, Wisconsin

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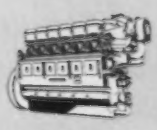
GM258

SYMONS® GYRATORY CRUSHERS

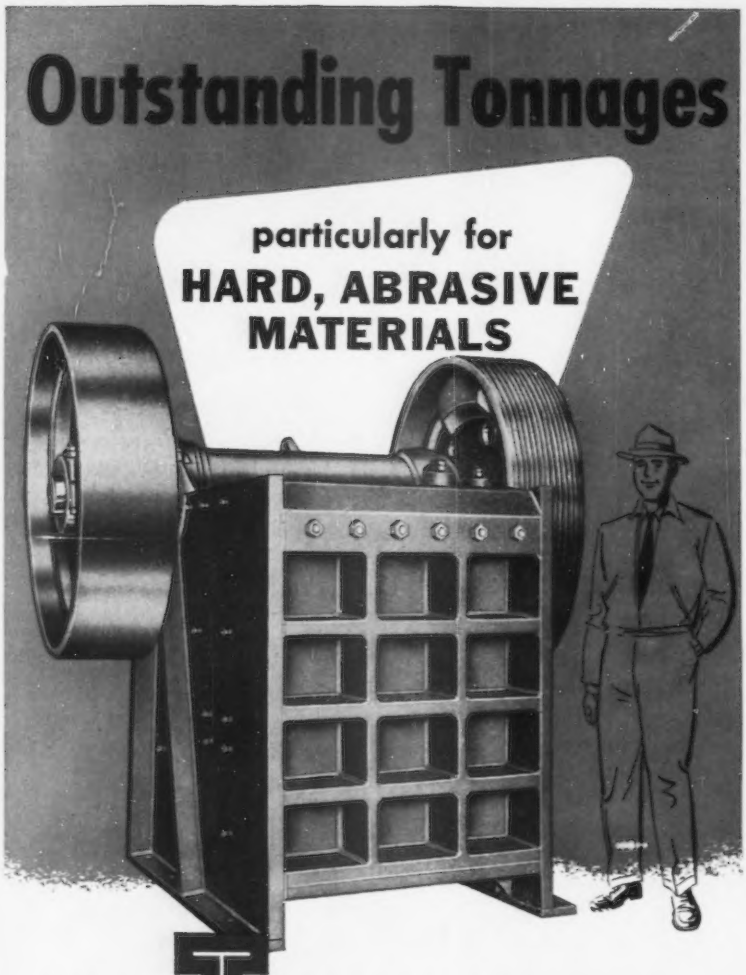
SYMONS CONE CRUSHERS

NORDBERG MINE HOISTS

SYMONS VIBRATING GRIZZLIES and SCREENS



NORDBERG ENGINES



NEW McLANAHAN JAWMASTER CRUSHERS

With force-feed action and long jaw design, these high-capacity, all steel Jawmasters feature roller bearings throughout. There are thirteen models—ranging from 10 x 16 to 40 x 48, with capacities up to 750 tons per hour.

Write for Bulletin JM-56.

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McLANAHAN
Manufacturers — Founders — Machinists
Sales Offices in Principal Cities of the United States
Pit, Mine and Quarry Equipment Headquarters Since 1835

Colorado *(Continued)*

Colorado's Board of Land Commissioners, in an effort to be of some aid to the uranium miner in Colorado, has just posted a notice cutting the royalty rate on state leases from its present 15% down to 12½%.

Success Mining and Exploration Co., headquartered in Idaho Springs, is developing a beryllium and feldspar deposit on the Brandt ranch on the east slope of Floyd Hill.

Mike Cleary, Idaho Springs, president of the company comprised of a group of Colorado men, says prospecting and exploration has been under way on the Brandt ranch for about a month, and a promising-looking vein has been uncovered. Company is putting in a compressor and air drills and they plan to make test shipments of the beryllium and feldspar to determine its marketability.

Millington mine, a famous high grade silver producer high above Lawson, was leased by Charles E. Fetterhoff and operated by Jack Pine Mining Co. All four levels of the mine were caved and clean-up work was started on No. 2 and No. 3 levels to open them for exploration. Samples already taken indicate some mill grade ore available, but due to oxidation and the presence of all types of silver minerals, some laboratory mill testing will be made before ore is shipped.

Antero Refining Corp., located near Salida, is expanding from a pilot plant operation to a commercial size plant to meet increasing demands for beryllium oxide and beryllium metal.

L. C. Moss, president of the corporation, stated that addition of larger reactors and expansion of the plant buildings are now under way. The chief source of beryl ore is the beryl deposit on Mt. Antero. However, officials of the corporation stated that when the expansion program is over they will be in the market for beryl ores from other sources.

George H. Sager operations at the Boomer Lode, 11 miles northwest of Lake George in Park county were in 1957 again, the principal producers of beryl in the state. Extensive exploration and development work was conducted on the property by Lowrey-Nelson Mining Co. of Colorado Springs, which announced important discoveries of beryl ore.

Most of the beryl output in the State in 1957 was sold to the Government but some was sold to Beryl Ores Co., Arvada, and International Minerals & Chemical Corp., Parkdale. A small quantity of columbite-tantalite was produced as a by-product of beryl and sold to the Beryl Ores Co.

Basic Exploration Co., of Eagle County, has signed a $12,000 contract with the Government to explore for uranium. Defense Minerals Exploration Administration said that the Government's portion of the contract is $9,000. Under the contract, the private firm must repay the Government if it strikes ore.

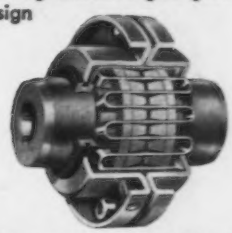
How one FALK coupling saved more than $1,000 per month

Pictured below is a Falk Steelflex Coupling assembly which connects a 2500 hp motor to a reduction unit driving an 18" bar mill in a Midwestern steel plant. This coupling replaced another type which broke repeatedly, causing maintenance expense averaging $1,000 a month—plus costly production losses. Since installation of the Falk Coupling, with its controlled torque mechanism that disengages when a predetermined overload occurs, there has been no interruption of production. Savings in maintenance and in lost production time are well in excess of $1,000 per month...dramatic proof of the importance of coupling design!

Long coupling life is not the sole criterion of coupling performance. Inadequate shaft couplings may be the cause of bearing damage or shaft breakage on your machines. If so, a change to Falk Steelflex will give twofold protection to your connected machines: (1) compensation for reasonable degrees of shaft misalignment, and (2) torsional resiliency to reduce peak loads as much as 30%. These advantages are as important to you as the long service life of the Falk Steelflex Coupling itself.

Falk Steelflex Couplings, in types and sizes to meet virtually all industrial applications, are promptly available from distributor, warehouse and factory stocks. Consult your Falk Representative or Authorized Falk Distributor.

Basic **Type F**—cutaway view showing exclusive grid-groove design



THE FALK STEELFLEX ...a truly flexible coupling

Here is the coupling that has all the strength of steel, yet is truly flexible. More than a million have been bought for industrial service of many kinds.

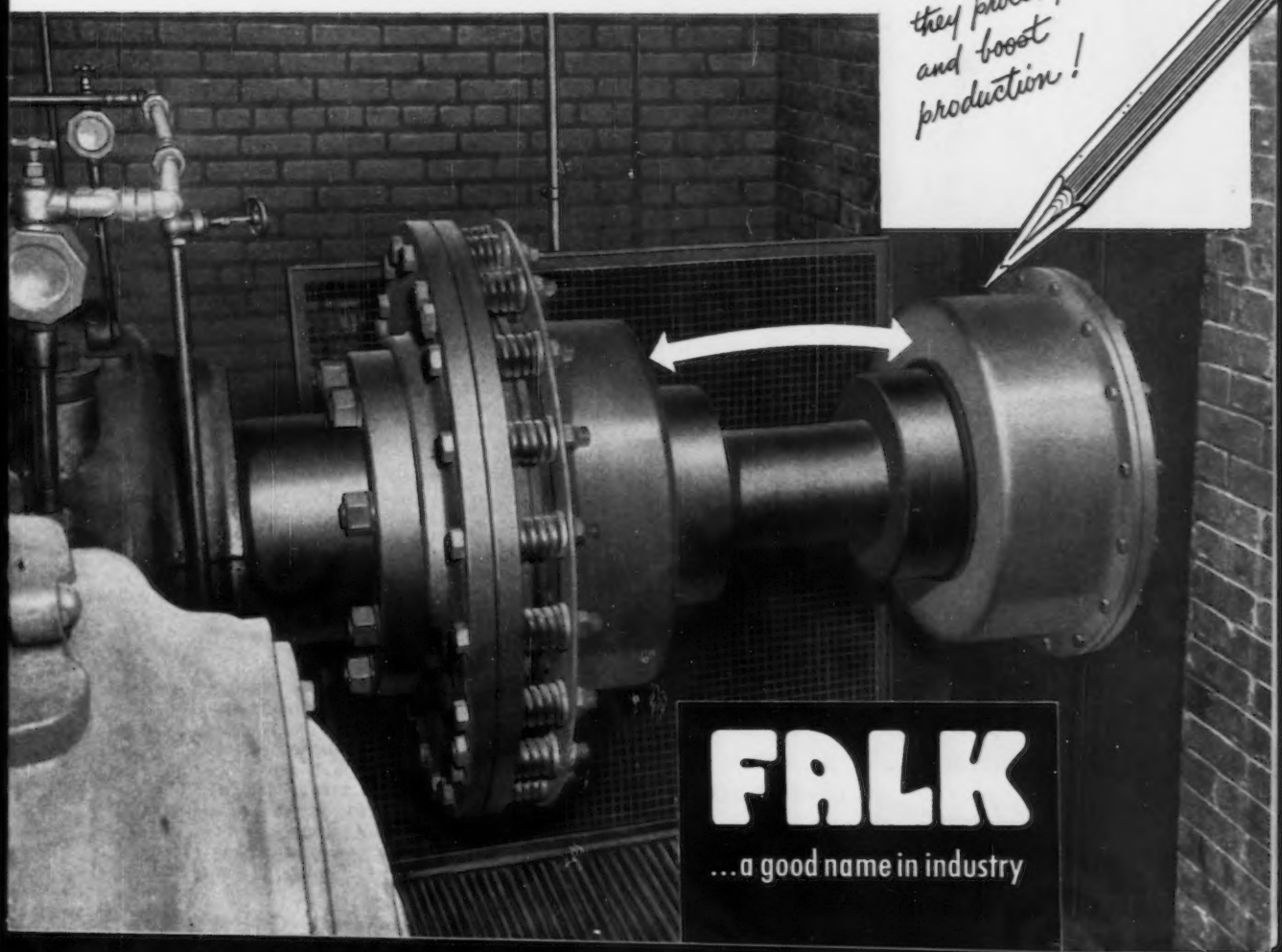
Because, in addition to its inherent superiorities of design, the Type F Steelflex can be used horizontally or vertically without modification or special parts, it has been adopted as standard in many plants—and by many designers and manufacturers of industrial equipment...Write for Bulletin 4100.

THE FALK CORPORATION, MILWAUKEE 1, WISCONSIN

MANUFACTURERS OF QUALITY GEAR DRIVES AND FLEXIBLE SHAFT COUPLINGS

Representatives and Distributors in many principal cities

Good couplings not only connect machines; they prolong machine life and boost production!



SEMI-
AUTOMATIC
Vulcan
DENVER
HOISTING
Proves Economical
In Inter-Level Service Shaft
In Arizona Copper Mine

A two-compartment service raise between levels at an Arizona copper mine uses a semi-automatic Vulcan installation which eliminates full time use of two hoist operators and two cagers, and complies with existing mine laws. Selector switches interlocking with geared limit switches and other safety controls permit cage operation from either level or from the cage. A set of by-pass switches permit the lowering of long material suspended under the cage simply and safely.

The Vulcan-Denver hoist is actually a 6,000 lb. two speed winch, with worm gear drive and grooved drum to give 115 F.P.M. high speed and 57 F.P.M. low speed cage travel. Total time between levels is less than 75 seconds. The features of Vulcan design and construction in this case are the same rugged, dependable characteristics that have made Vulcan-Denver hoists and slushers famous for economy and long service throughout the world.

An adaptation of this equipment is driving raises in iron mining. Initial operation by remote control more than doubled the Feet-Per-Man-Shift. No hoist operator needed.

Let us consult on your hoisting application, including remote or automatic control for economical, safe, well adapted operation.

Represented Internationally through DORR-OLIVER, INC., Stamford, Conn., and associated firms.

Vulcan
IRON WORKS CO.

IN DENVER SINCE 1891

2960 SOUTH FOX
ENGLEWOOD, COLORADO

Colorado *(Continued)*

Incorporation papers for the newly organized American Metal Mine Owners have been filed with the Colorado secretary of state by the organizers, many of them active in Colorado political circles. According to the incorporators, the new organization "will not seek to replace or supplant any existing organizations" but will provide an organization "for all metal miners that can more adequately serve their purpose."

Trustees of the new corporation include former Gov. Dan Thornton, Joseph F. Little, John W. Metzger, William Lloyd, Ben Poxson, Roy Burkett, Richard K. Ayers, Mike Cloonan and Mrs. Elizabeth Pellet.

Idarado Mining Co.'s operations in the San Juan area produced over 455,000 tons of base ore in 1957. This represents a slight production decrease from the 1956 record peak. Despite the adverse metal market, Idarado, during the past year has stepped up its development work and has initiated a diamond-drill program.

Completely integrated electrical power, compressed air, ventilation and telephone communication have facilitated the successful operation of the property. The company ores yield lead and zinc, also copper, silver and gold. John S. Wise is the general manager.

Development of a 50-year mica operation is scheduled to get under way with the building of a 200-ton mill three miles north of Howard. Property is owned by the Furphy Mining Co. and has been leased to Hi-lo Minerals, headed by Keith Alexander of Villa Grove. The mill will be adjacent to the source of supply. Joe Furphy said the deposit is pinpoint scrap, a millable mica. A mica grinder has been ordered from Germany. Mills are being obtained from the Clute Corp. of Rocky Ford.

IDAHO

Easterly drifting on Sunshine Mining Co.'s 3700-ft level has opened 112.5 ft of 40-oz silver ore averaging about 5 ft wide in the West Purim area of the Silver Belt. The drift, which is on the Polaris 09 vein, had been in good ore for about 140 ft in the Omega area before passing into New Purim ground.

Lucky Friday Silver-Lead Mines Co. has opened its silver-lead vein on the new 2600 level and has found the orebody to be equally as wide and rich as on upper levels. Easterly drifting to develop the new level is now in progress. The orebody has been lengthening as depth has been gained. On 2450 it has been exposed for 1200 ft and the east face is still in ore.

Easterly drifting along the Alhambra fault-vein in the Bunker Hill Co.'s Crescent Mine between Wallace and Kellogg was resumed following the conclusion of a boundary and ore rights agreement with adjoining Sunshine Consolidated Inc. in February and more than

"T-1" Steel cuts cost of truck liners 75%

—doubles their life

Dumping a 41-ton load in 10 seconds causes terrific abrasive and scouring action. USS "T-1" Steel gave double the life under these conditions.

Five 26-cubic-yard dump trucks hauling copper ore were lined with USS "T-1" Steel plates more than a year ago. These have been in service at the Copper Cities Division of Miami Copper Company mines at Miami, Arizona.

None of the USS "T-1" Steel liner plates has worn out yet, according to the Acting Master Mechanic. What's more, the old liners became dented and jammed by the impact from large chunks of ore and it was necessary to un-jam them to get them out. Now, by using USS "T-1" Steel plates furnished to a minimum of 321 Brinell hardness, impact is no longer a serious problem.

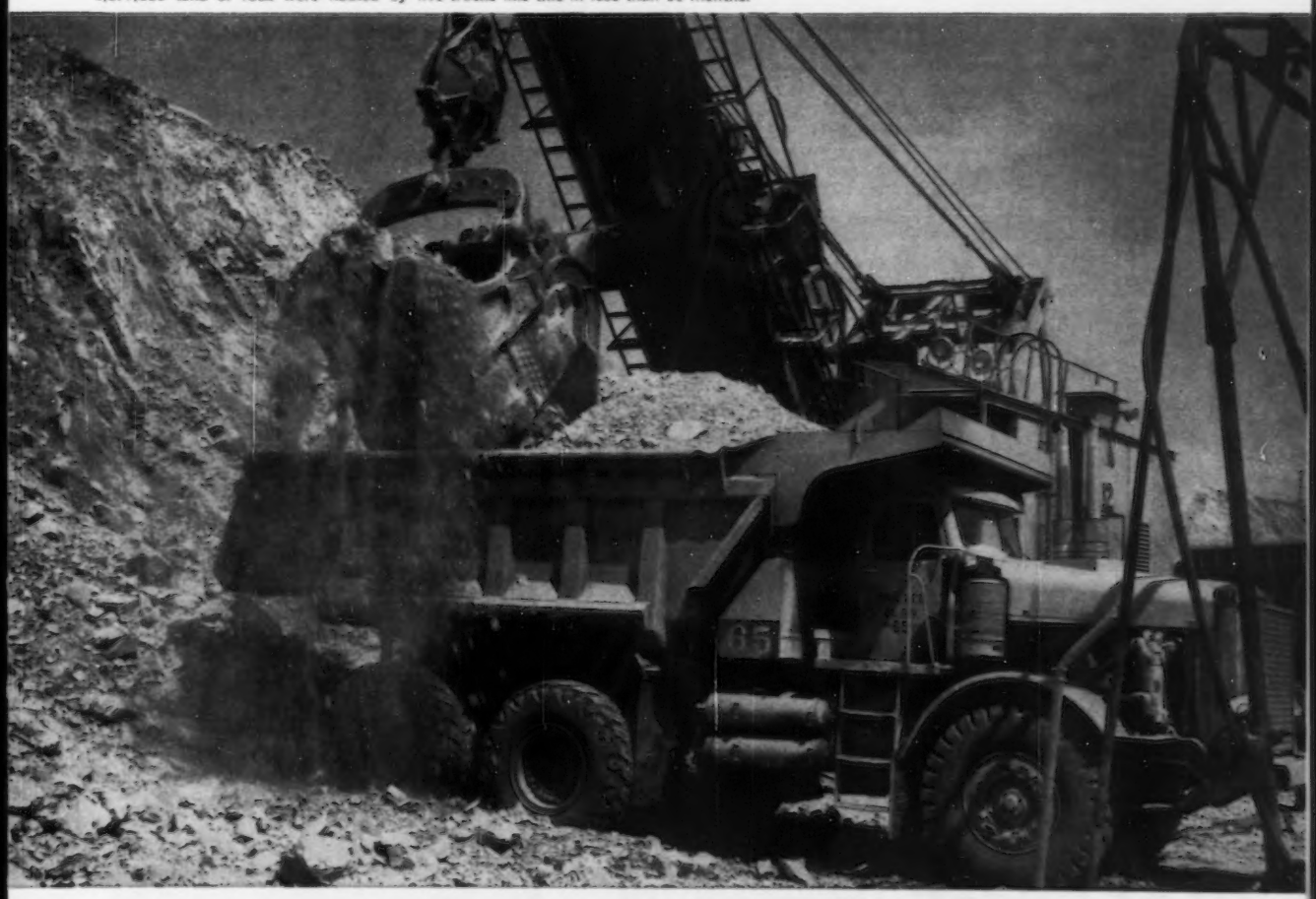
USS "T-1" Steel offers a combination of advantages not found in any other steel. It has a minimum yield strength of 90,000 psi, almost three times that of structural carbon steel. It has high resistance to impact abrasion, can be formed and welded, and retains its strength after welding—even when used at temperatures as low as -50° Fahrenheit.

Why not get the complete story? Write for our free book containing technical data and practical application stories. United States Steel Corporation, Room 2801, 525 William Penn Place, Pittsburgh 30, Pa.

Remember that we also make USS COR-TEN, MAN-TEN and TRI-TEN high-strength low-alloy steels—standards for heavy-duty equipment.

USS, Cor-Ten, Man-Ten, Tri-Ten, and "T-1" are registered trademarks

3,877,880 tons of rock were hauled by five trucks like this in less than 10 months.



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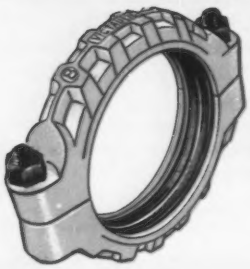
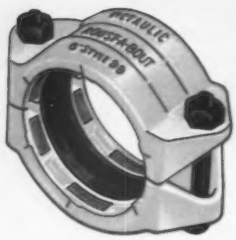
METHOD OF PIPING

VICTAULIC HAS EVERYTHING...



VICTAULIC COUPLINGS
Simple, fast, reliable. *Styles 77, 77-D,* for standard uses with steel or spiral pipe, — *Style 75* for light duty. Other styles for cast iron, plastic and other pipes. Sizes ¾" to 60".

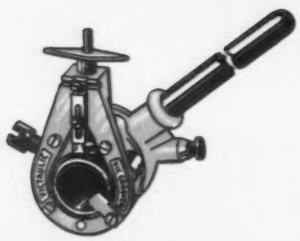


ROUST-A-BOUT COUPLINGS
For plain or beveled end pipe *Style 99.* Simple, quick, and strong. Best engineered and most useful plain end coupling made — takes a real "bull-dog" grip on the pipe. Sizes 2" to 12".

VICTAULIC SNAP-JOINTS
The new, boltless, speed coupling, *Style 78.* Hinged into one assembly for fast piping hook-up or disassembly. Hand locks for savings in time and money. Ideal for portable lines. Sizes 1" to 8".

COUPLINGS FOR EVERY PIPING JOB

VICTAULIC FULL-FLOW FITTINGS
Elbows, Tees, Reducers, Laterals, *a complete line*—fit all Victaulic Couplings. Easily installed — top efficiency. Sizes ¾" to 12".



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VICTAULIC COMPANY OF AMERICA
P. O. BOX 509 • Elizabeth, N. J.

Idaho *(Continued)*

225 ft of ore had been opened by the end of March. Company officials described the silver-copper ore as "good, but spotty" and termed the development as "very encouraging."

Sawyer Petroleum Co. of Los Angeles has purchased what it believes to be one of the largest known deposits of thorite in North America, located at Lemhi Pass on the Idaho-Montana border, and plans to develop it and produce thorium concentrates.

The property was purchased from Ragand Minerals Co., Dallas, Tex., along with other Ragand assets, for $128,000 and 600,000 shares of Sawyer stock, with a 3% royalty reservation.

Clayton Silver Mines is continuing shaft-sinking operations on a one-shift basis at its property in the Bayhorse District of Custer County and expects to have a new 800-ft level open by the end of 1959. Project is expected to add 9 to 10 years to the productive life of the mine. Reserves above the 500 level at the end of 1957 were estimated at 96,023 tons, sufficient for about three years' operation at mill capacity. Last year the company showed a net profit of $35,668, after writing off a net loss of $57,212 on its Ransom uranium mine venture in Utah.

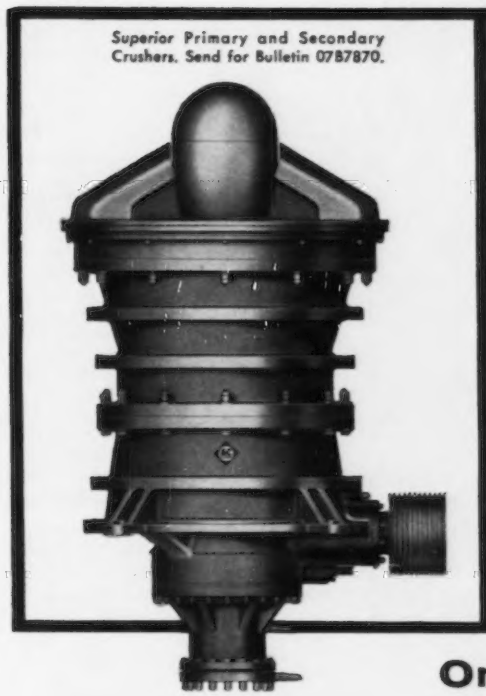
Lone Pine Mining Co., a newly-organized Idaho firm, is planning to commence operations soon at a gold property acquired from P. J. Miller of Lewiston in Idaho County near Golden. The claims have not been operated since the enforced World War II shutdown.

Vulcan Silver-Lead Corp., 61%-owned subsidiary of Callahan Zinc-Lead Co., last year received a total of $378,039 in royalties on production of 123,129 tons of ore from its Galena Mine in the Coeur d'Alene District, which is operated by Asarco under a long-term lease agreement. Present reserves in the mine have an estimated gross value of $23-million.

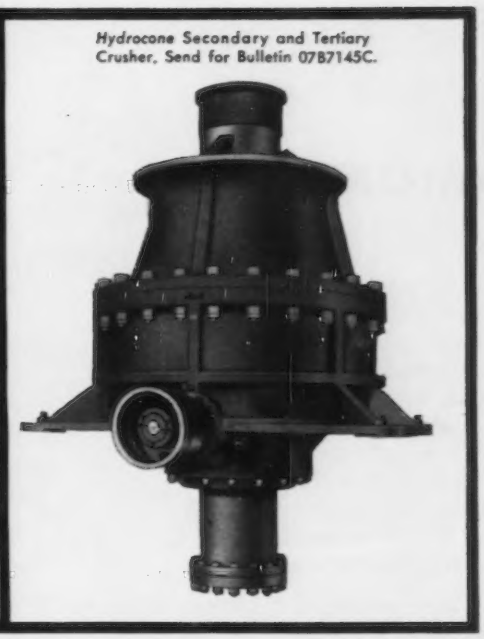
A proposal to merge the Vulcan firm into Callahan was to be voted on by Vulcan stockholders on April 7 and by Callahan stockholders on April 14. Approval by both groups was anticipated. Callahan Mining Co. would be the name of the surviving firm.

Lookout Mountain Mining & Milling Co. and Caledonia Silver-Lead Mining Co., Kellogg have acquired oil and gas leases in a California oil district and are negotiating for additional acreage in the area. The two firms have also taken an option on what they describe as a "very attractive" silver-producing property near Fallon, Nev. The new joint ventures represent the initial steps under a new diversification policy.

Caledonia's gold properties in the Lewiston area of Montana have been idle for a number of years because their operation is uneconomic at the fixed $35 gold price. Its holdings in the Wardner area of the Coeur d'Alene District have been transferred to Yreka United Inc. for 400,000 shares of Yreka stock, as part of a big merger deal which



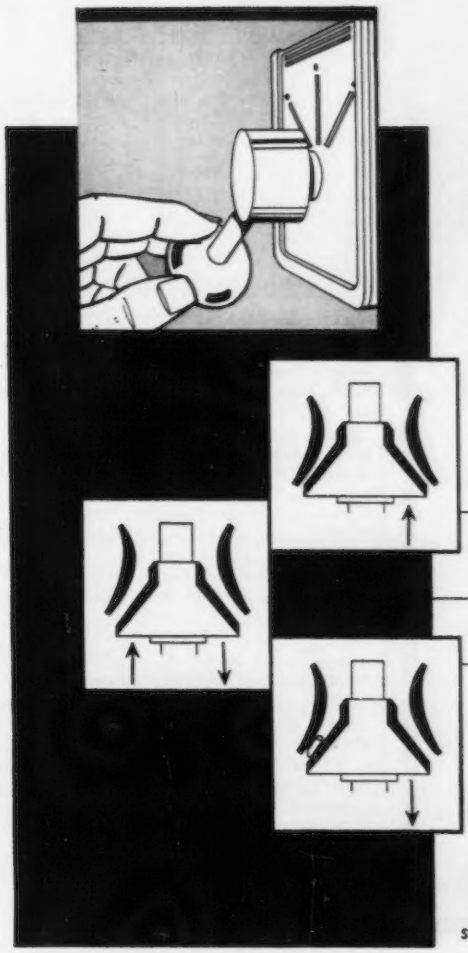
Superior Primary and Secondary Crushers. Send for Bulletin 0787870.



Hydrocone Secondary and Tertiary Crusher. Send for Bulletin 0787145C.

Only Allis-Chalmers gyratory crushers have exclusive

Hydroset mechanism...



HUNDREDS of crushing operators around the world have improved their plant efficiency and tonnage with Allis-Chalmers gyratory crushers equipped with *Hydroset* mechanism. This remarkable design feature has provided economy and convenience in crushing a wide range of materials — from andesite to zinc ore, and including the crushing of taconite in the world's largest crusher. No other gyratory crusher even approaches the time-saving advantages of "one-man, one-minute" product control offered by Allis-Chalmers crushers equipped with *Hydroset* mechanism.

"One-Man, One-Minute" product control

Hydroset mechanism raises or lowers the mainshaft hydraulically in less than a minute — at the flip of a switch.

Compensates for wear on mantle and concave ... saves hours of production time — with the flip of a switch.

Changes crusher settings in less than a minute — with the flip of a switch.

Clears crushing chamber in case of power failure or other emergency — with the flip of a switch.

The A-C man in your region will gladly give you all the details. Or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wis.

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Why use a

DIAMOND *bit?*

Diamonds do the job better . . . for less. In many applications, one diamond bit performs the work of several ordinary bits. Under certain conditions only diamond bits will do the job where nothing else can make hole, and only diamond core bits and barrels guarantee maximum core recovery under varying conditions.

Why use a

CHRISTENSEN *diamond bit?*

Christensen diamond equipment is engineered to the job, giving best results in any formation. Christensen sells not only the diamond equipment, but also offers the services of a qualified field engineer whose education, experience and "on-the-spot" availability can prove of tremendous value to the operator. Wherever there is mining activity, anywhere in the world, there is a qualified Christensen engineer for consultation on any drilling problem and ready to provide the specific diamond equipment needed for your job . . . now, and in the years to come. Call Christensen, and operate at "less cost-per foot."

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Idaho *(Continued)*

contemplates eventual deep development by the Bunker Hill Co.

Lookout's lead-zinc property in the Pine Creek area of the Coeur d'Alene District is also inactive, due to the low lead-zinc price, but the company also has extensive uranium holdings in Wyoming and Utah on which further exploration is planned.

ILLINOIS

Rosiclare Lead and Fluorspar Mining Co. has leased its Ohio River barge-loading facilities to Southern Illinois Mining Co., latest entrant in the fluorspar district. The lease, effective April 1, is for one-year duration and specifies use of the equipment for shipment of fluorspar only. The docks are located at the foot of Main Street, in Rosiclare, Ill.

Due to present economic conditions, three major producers in the Illinois fluorspar district have made slight reduction in the work week or reduction in force.

Minerva Oil Co. laid off only 30 out of a force of 200 employees and made no cut in hours, continuing its 5-day week schedule.

Ozark-Mahoning Mining Co. reduced its work week from six to five days.

Aluminum Co. of America, Rosiclare Works, reduced its work schedule from five to four days a week, effective April 1, and cut the employee force by approximately fifty-five.

Hoeb Fluorspar Mining Co. has leased an area of 153 acres, known as the Charlie Jerrells property, in the northeast section of Hardin County, Ill., and expects to start drilling at an early date.

MICHIGAN

Mining companies paid nearly 70% of Iron county (Menominee range) taxes for 1957. M. A. Hanna Co. paid the highest percentage—35% and $629,493; Inland Steel Co., operating the Sherwood and Bristol mines, paid 17.31% and $311,664; Pickands, Mather & Co., 9.3%, $167,332; Republic Steel Corp., 4.21% with $75,817 and North Range Mining Co., 2.87% and $51,573.

Valuations for the county gained $167,000 over 1957. Iron River Township increased $729,000 but Crystal Falls Township lost $605,000. The Wauseca-Aronson of M. A. Hanna Co. at $6,100,000 and Inland's Sherwood, $5,380,000—both in Iron River Township—had the highest recommended valuations for 1958. The Fortune Lake mine of Pickands, Mather & Co., because of being closed down and its open pit ore exhausted, had its recommended valuation reduced from $657,000 to $20,000, accounting for the loss in Crystal Falls Township.

Pickands, Mather & Co.'s Peterson mine at Bessemer now has a mechanical ditch

JIM'S ON A SPOT

an ordinary tire "blew" the job

but JACK'S ON THE DOT with

U.S. ROYAL SAFETY 1st TRUCK TIRES

contractor-proved against job delays!

At all kinds of construction projects, all around the nation, contractors have *proved* that using U. S. Royals prevents costly tire delays, keeps jobs on schedule!

Why?... because today's U. S. Royal Tires have exclusive, advanced features that deliver extra traction, greater strength, longer wear. And because they're backed up by expert on-the-spot *service* and complete, convenient *retread facilities.*

Ask your U.S. Royal Dealer to demonstrate how these contractor-proved tires can help cut delays on *your* project.

And be smart—specify "U. S. Royal" on your next new equipment!

U. S. ROYAL NYLON TIRES ARE TOUGHER, STRONGER, SAFER.

US RUBBER **United States Rubber**

Rockefeller Center, New York 20, N. Y.

In Canada: Dominion Rubber Co., Ltd.

Coal Chief scoops and dumps 100 tons a minute!

Four Boom Support Strands, each 3⅝" dia., support the huge boom which towers 160 feet above the ground. These Tiger Brand cables are designed for long service life.

USS American Tiger Brand Hoist Rope. Two of these 2⅝" dia. shovel hoist ropes supply the guts to lift the heaviest loads.

Rigged with USS American Tiger Brand Wire Rope

Here's the latest of the big diggers, the Coal Chief, built by Marion Power Shovel Company. It can scoop up 70 cubic yards at a bite, swing it approximately the length of a football field and dump it in piles more than 96 feet high. It makes the round trip in less than 60 seconds.

This strip mining operation is a joint venture between Simco Peabody Company and Columbus & Southern Power, Columbus, Ohio. All the coal produced will be furnished to the power company . . . about 8,000 tons a day.

The new shovel, like its two predecessors, is rigged throughout with USS* American Tiger Brand Wire Rope. The tremendous power of the shovel is handled by two hoist ropes 2⅝" diameter, and the gigantic boom is supported by four lengths each 105½ feet long, of 3⅝" diameter galvanized boom support strand. Each strand has a catalog strength of 768 tons, for a total of 3,072 tons.

Your equipment may not need such large wire rope, but the fact that all applications on this huge shovel are handled by standard USS American Tiger Brand* constructions emphasizes the quality of the engineering that goes into the complete line of Tiger Brand Wire Rope. For more information, write American Steel & Wire, Rockefeller Building, Cleveland 13, Ohio.

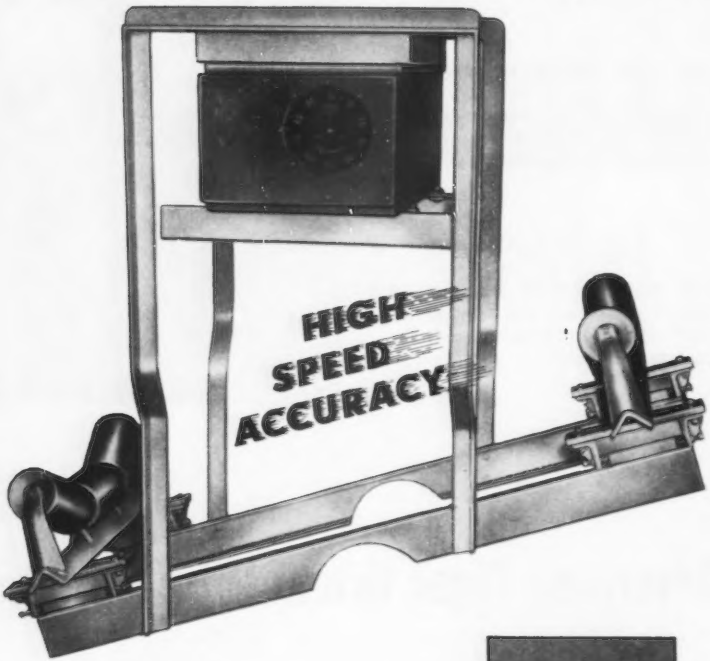
American Steel & Wire
Division of USS United States Steel

*TRADEMARK

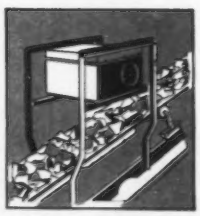
Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors • Tennessee Coal & Iron Division, Fairfield, Ala., Southern Distributors
United States Steel Export Company, Distributors Abroad

6,000 tons of overburden per hour can be stripped by this new 70-cubic-yard Marion shovel built for Simco Peabody Company and Columbus & Southern Power.

NEW Thayer Inventory Scale

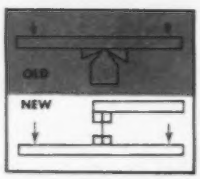


Totalizes continuously and accurately any material being conveyed on an endless belt. Newly designed Thayer Scale fits over level or inclined systems at any location for direct or remote reading. Thayer Scales of 100 lbs. or 300 tons per hour capacity are available.



Recalibrates linearly with direct setting by just placing a known weight on the scale platform. The belt is not disturbed. No chains or involved calculations are necessary. Setting is positive, accurate, and long lasting.

Exclusive Thayer Plate Leverage System is guaranteed accurate for the life of the scale. There are no knife-edge pivots to wear down. Neither dust nor dirt nor vibration can affect its high accuracy. Thayer Scales are unsurpassed for simplicity and reliability under rugged conditions.



Write us about your bulk weighing problems for inventory or batching purposes.

THE Thayer SCALE

*THE THAYER SYSTEM OF PROCESS CONTROL BY WEIGHT

AUTOWEIGHTION

THAYER SCALE CORP., 14 Thayer Park, Pembroke, Mass.

Michigan *(Continued)*

digger which replaces the considerable amount of pick and shovel drainage ditch digging necessary in the past.

Four of the five old underground mines still operating on the Gogebic range are Pickands, Mather & Co. properties, the Sunday Lake at Wakefield; the Newport at Ironwood; the Cary at Hurley and the Colby—now included in the Paterson—at Bessemer. All four were opened in the 1880's.

W. F. Shinners, Iron River, manager of M. A. Hanna Co. mines, has stated that the company "expects to continue on a four-day week without further curtailment in the foreseeable future." He announced that the proposed surface facilities at the new Homer-Wauseca shaft will not be constructed this year due to decreased production by affiliated steel companies. Construction on the headframe is near completion, hoisting equipment is being installed and underground development on a new level is being continued.

At the Hiawatha mine, construction of a sand plant for preparation of underground filling material is nearly completed and the Cannon mine is planning a similar plant.

Of a total of 154,202,473 tons of Michigan iron ore reserves, the Marquette range shows 64,463,706 tons and the Menominee range 62,971,178 tons.

Grover G. Holt, assistant to the president of Cleveland Cliffs Iron Co., predicts that, within 30 to 40 years, there will be no underground mines on the Marquette range. All the ore, he believes, will be low grade and will be mined from open pits. He said that the company's Republic and Humboldt pits will be expanded in the near future. The company plans to open up other underground mines, but he did not state when or where. He anticipates no decrease in employment in the Negaunee-Ishpeming area where the company now has a maximum of 3,200 employees. He thinks that new developments will absorb the men released from exhausted underground mines. The Cliffs' pellet plant at Eagle Mills is currently producing about 1800 tpd. Mr. Holt says that, though some major changes will be made, the problem of concentrating the low grade jasper ore has been licked.

Inland Steel Co. is exploring a property on the Menominee range which adjoins its Sherwood mine. Results to date have been encouraging.

Cleveland Cliffs Iron Co. has shut down its Humboldt open pit mine and plant for repairs and changes in the plant. The flotation plant has been treating low grade, non-magnetic ores since 1954.

MINNESOTA

Supplementing former reports in Lake Superior area news items of Great Northern Ry. Co.'s interest in nonmag-

CLIMAX MOLYBDENUM COMPANY
A DIVISION OF AMERICAN METAL CLIMAX, INC.
CLIMAX, COLORADO • TELEPHONE: CLIMAX 5111
NEW YORK OFFICE, 500 FIFTH AVENUE
GOLDEN, COLORADO OFFICE, MINES PARK

Le Roi Division
Westinghouse Air Brake Co.
Milwaukee 1, Wis.

Your advertisement of air leg drills in the April issue of Engineering and Mining Journal has caused this company some very deep concern.

While we recognize that the ad doubtless resulted from the enthusiasm for the product by those who prepared the ad for Le Roi, our concern stems from several distinct inaccuracies and violations of policy. First, Climax was not given an opportunity to review, correct and approve the proposed ad copy before publication. The results of this were that the published ad copy was erroneous in certain sections of content, it misquoted R. M. Stewart, our assistant planning engineer, it inadvertently implied a poor representation of what we consider to be an excellent rock drill testing program carried on by our Planning Department, and it gave the erroneous impression that one product was preferred over all others for every type of drilling operation.

It is definitely not within the scope of our policy to make public release of some of our cost data. This was even more objectionable to us since some of the published data was badly in error. Neither would we have permitted a comparison of air legs with drifters since we feel each machine has its own special field of application at our property. The implication that we do not perform any preventive maintenance on our air legs is without any basis and does a serious injustice to Ray Stewart and our Planning, Mining and Mechanical Departments.

In view of the excellent relationship which has existed between the Le Roi Division, your Denver distributor and Climax Molybdenum Company, we felt that you would want to be advised of our concern about the ad. We are quite sure you will be as anxious as we are to correct the situation so that members of the mining industry and manufacturers of equipment will know exactly what our position is in this regard.

Very truly yours,

Robert Henderson

Robert Henderson
Resident Manager

We are presenting this statement by Climax Molybdenum Company in order that their outstanding planning and testing programs are not subject to any question.

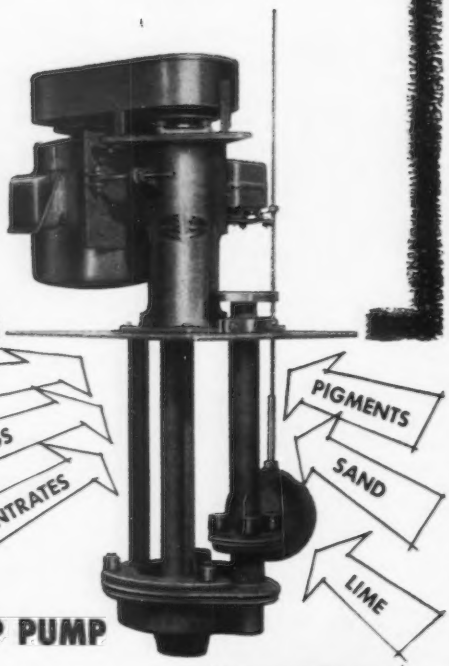
The data that was prematurely published was obtained by an outside industrial reporting service. We are all too aware of the need to present accurate information as a matter of principle as well as customer relations. To the best of our knowledge this is the first and only instance an exception has occurred.

We deeply regret the embarrassment we inadvertently caused Climax Molybdenum Company. We are very appreciative of their understanding as expressed in their open letter.

Le Roi Division of Westinghouse Air Brake Co., Milwaukee 1, Wisconsin

You sump it . . we pump it!

CORROSIVES!
ABRASIVES!
FROTHS!

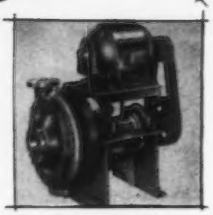


GALIGHER

ACID-PROOF SUMP PUMP

The exclusive design of the rugged Galigher Acid-Proof Sump Pump completely eliminates packing, seals and submerged bearings. This allows large clearance between pump shaft and stationary wetted end parts, removing the most common cause of pump troubles. This makes the Galigher Sump Pump ideally suited for easy handling of even the most gritty and abrasive solutions containing up to *60%* solids. Capacity—10-500 G.P.M., heads up to 100 ft.

Available in natural or synthetic rubber, plastic covering, hard iron or stainless steel... direct and V-drives.



The VACSEAL Pump

Precision engineered for rugged use. Exclusive impeller design eliminates gland water.

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GALIGHER PRODUCTS: AGITAIR® Flotation Machine, VACSEAL Pump, Geary-Jennings Sampler, Acid-proof Sump Pump, Geary Reagent Feeder, Laboratory AGITAIR® Flotation Machine, Laboratory Pressure Filter, Laboratory Ball Mill, Rubber Lined and Covered Products, Plastic Fabrication

Minnesota *(Continued)*

netic taconite, a recent study of Great Northern prepared by Hayden, Stone & Co., states that "there are large quantities of nonmagnetic taconite in Great Northern's territory on the west end of the Mesabi range" and that the Railway is undertaking, with the help of the Universities of Minnesota and North Dakota, a research project toward developing an economical process for producing commercial concentrates from it. The report adds that, notwithstanding the potential competition of both new ore supplies and subsidized water transportation, there seems little doubt that, for many years to come, a combination of low mining and low transportation costs will enable the Mesabi range to continue as the number one source of high grade ores for steel mill consumption in the U. S.

A joint study is being made by the Great Northern and Northern Pacific railroads as to their possible unification including their subsidiaries, the Burlington and the Spokane, Portland and Seattle. Both the Great Northern and Northern Pacific roads are active in iron ore haulage from the Mesabi and Cuyuna ranges.

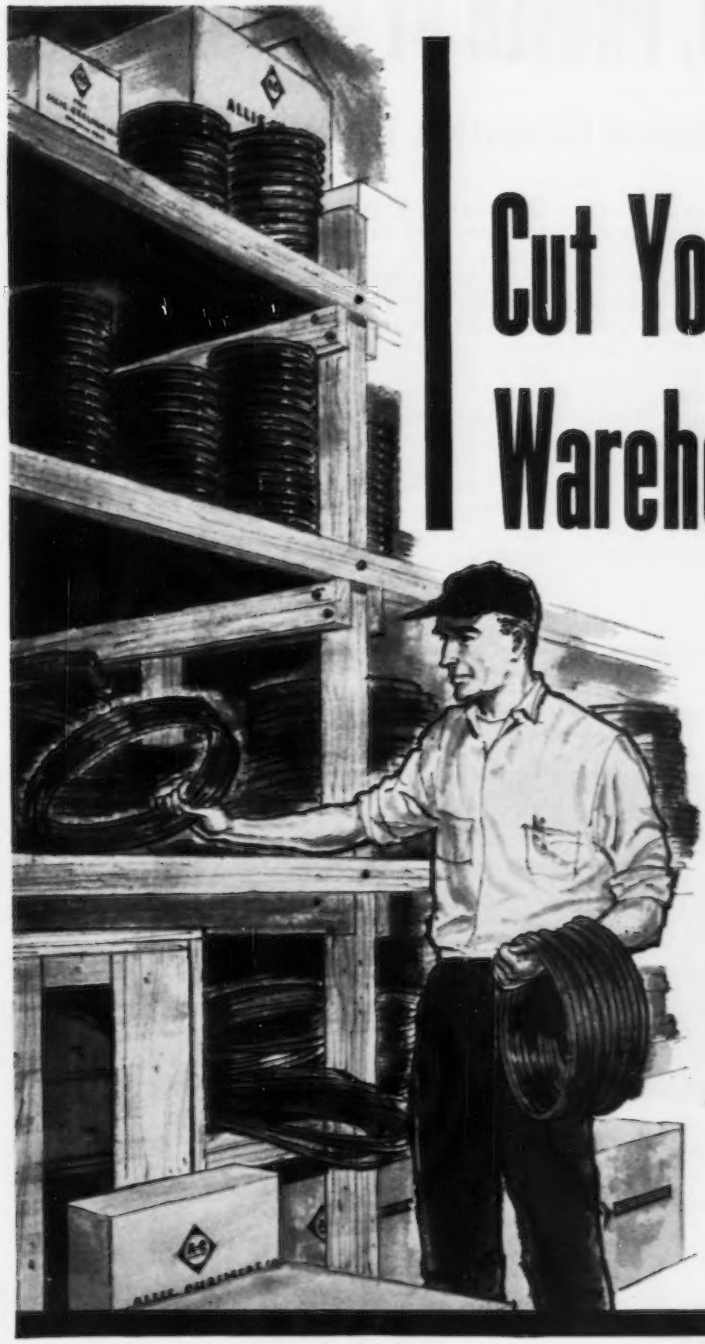
The St. Louis county commissioners denied an application by Rouchleau-Ray Mining Co., R. B. Whiteside, Hunter Mining Co. and Charles D'Autremont to repurchase tax delinquent taconite lands near Virginia. Haley-Young Mining Co. had asked for a taconite lease on the property in February 1952, offering 28c per ton royalty on taconite concentrates —double the legal minimum. Ray D. Nolan, director of the Minnesota Division of Lands and Minerals, pointed out that the property contains an estimated 1½-million tons of taconite and would eventually bring the state $400,000 instead of the $3,045 due in delinquent taxes. Nolan said that, while a lease was not issued to the Haley-Young Mining Co., they were legally entitled to it. A similar situation is said to exist on adjoining property.

At Babbitt a local committee cooperating with state and county historical societies and Reserve Mining Co. is planning a celebration for June 20-22 in honor of Peter Mitchell, early explorer. A monument, which will be a 20-ton taconite rock, will be dedicated June 22 to him and to commemorate the discovery of taconite on the Mesabi range.

Oliver Iron Mining Division carried on active stripping through the winter at its Stephen, Gilbert, Rouchleau, Pilotac, Monroe, Shermen Group, King, Arcturus and Plummer mines, distributing this winter work well along the Mesabi range.

Pickands, Mather & Co. concluded its winter stripping program at its Tioga No. 2, Bennett, Mahoning and Embarrass mines before March 1st.

Iron Ore Co. of Canada in 1957 shipped its largest tonnage since its first production in 1954: 12,352,800 tons. This was 329,800 more than in 1956. The 1957 season ran from April 22 to Nov. 15



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Use your *Texrope* drive distributor as your warehouseman

Magic-Grip sheaves, *Texrope* belts, *Vari-Pitch* sheaves and motor bases, plus a wide variety of other industrial products — they're always available to you from your *Texrope* drive distributor.

This service means *you save* the cost of maintaining transmission equipment inventories of your own — costs that include insurance, taxes, handling, space and clerical help.

Let your *Texrope* drive distributor handle your inventory. You'll reduce costs and headaches. You can get his name from your local Allis-Chalmers office, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wis.

Here are other services available to save you time and money:

Factory-trained distributor personnel assure you fast and efficient service at all times — in emergencies, you can count on your distributor 24 hours a day.

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Republic Roof Bolts Assure Consistent Top-Holding Power

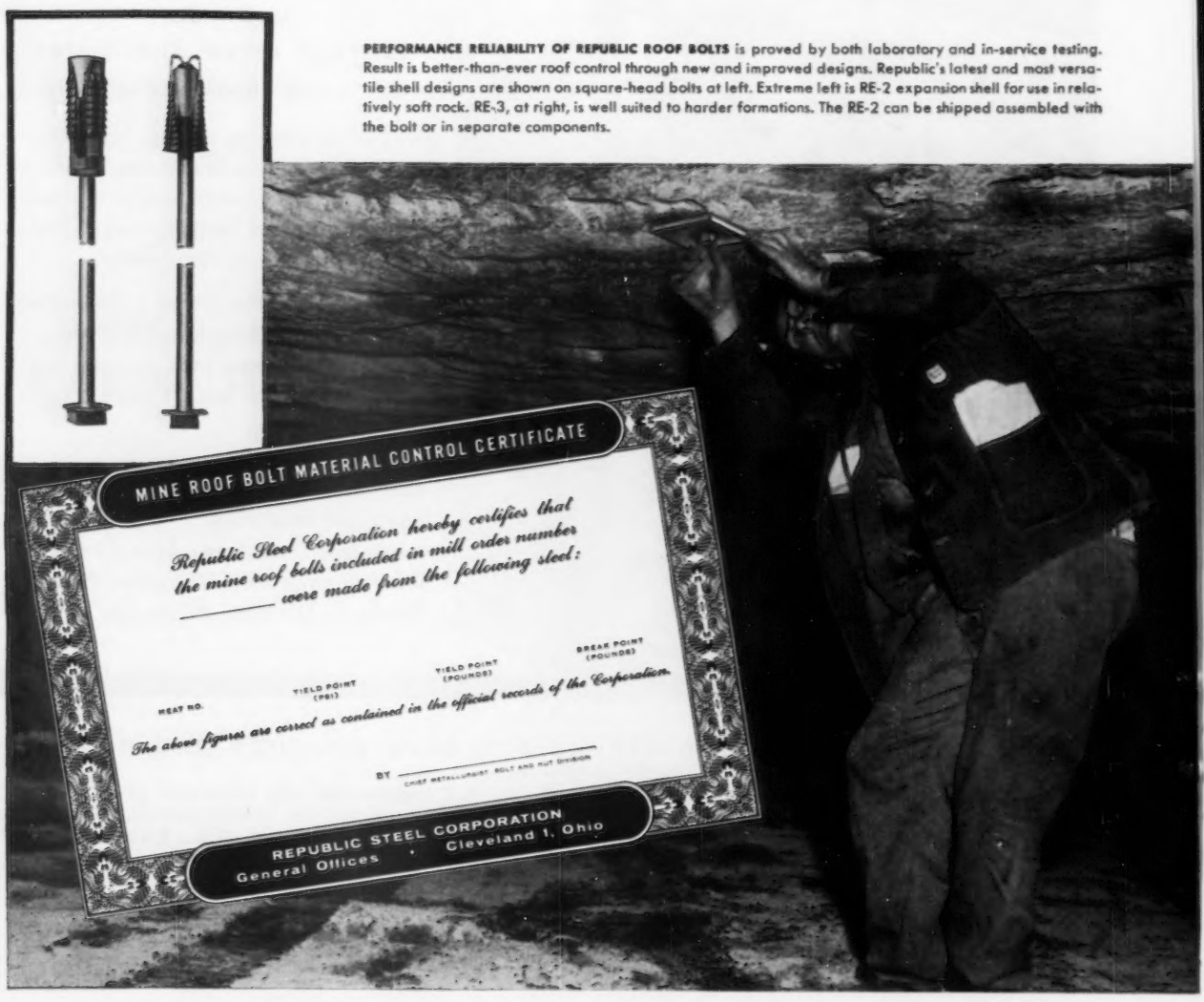
When you specify Republic Mine Roof Bolt Assemblies, you get two-way assurance of uniformly superior top-holding power.

First, Republic's exclusive Certification Program is direct evidence of the high standards maintained to protect roof bolt quality. Samples of every heat of steel used are tested to destruction to establish finished bolt performance. The results of these tests are entered on Material Control Certificates which accompany all roof bolt shipments, demonstrating that physical properties meet or exceed the suggested mining standards as approved by the American Mining Congress and American Standards Association.

Second, a continuous field-testing program to verify performance under actual service conditions is conducted in Republic's own mines. Before a new design is marketed, it must pass these tests. Complete data are assembled concerning its effectiveness in various types of strata using different methods of placement and spacing. Moreover, records are maintained to establish long-term performance.

In addition to laboratory and field testing, Republic helps you increase roof-control reliability by offering the most complete selection of roof bolt assemblies available from a single manufacturer. Wherever roof bolting is practical, Republic can furnish the type and size best suited to overhead conditions.

All of these facts make Republic Roof Bolt Assemblies your best choice for uniform top-holding power throughout your bolted-roof areas. For further information, contact your Republic representative or mail coupon.


MINE ROOF BOLT MATERIAL CONTROL CERTIFICATE
Republic Steel Corporation hereby certifies that the mine roof bolts included in mill order number _____ were made from the following steel:
HEAT NO.
YIELD POINT (PSI)
YIELD POINT (POUNDS)
BREAK POINT (POUNDS)
The above figures are correct as contained in the official records of the Corporation.
BY _____
CHIEF METALLURGIST BOLT AND NUT DIVISION
REPUBLIC STEEL CORPORATION
General Offices • Cleveland 1, Ohio

PERFORMANCE RELIABILITY OF REPUBLIC ROOF BOLTS is proved by both laboratory and in-service testing. Result is better-than-ever roof control through new and improved designs. Republic's latest and most versatile shell designs are shown on square-head bolts at left. Extreme left is RE-2 expansion shell for use in relatively soft rock. RE-3, at right, is well suited to harder formations. The RE-2 can be shipped assembled with the bolt or in separate components.

BOLTED ASSEMBLY PERFORMANCE can be no better than the fasteners used to hold it together. This is the reason it pays to specify REPUBLIC Bolts and Nuts. 20,000 standard and 8,000 special types and sizes are available to meet practically any requirement. Each is a product of integrated manufacturing control extending from ore mining to final inspection. Result is uniform high quality . . . the basis for absolute dependability. For facts, mail coupon.

REPUBLIC'S NEW TRUSCON STEEL BUILDINGS PERFORM WELL as permanent or temporary shelter for mine personnel, equipment, or material. These "Budget Buildings" are delivered as a complete package including roofing, siding, windows, doors, and hardware. They are easy to erect or dismantle and re-erect to meet changing needs. Sizes include 32-, 36-, 40-, 44-, and 48-foot widths; 12- and 14-foot heights; and any required length. Parts are galvanized to eliminate painting. Send for data.

REPUBLIC PLASTIC PIPE PROVIDES TOP PERFORMANCE in handling mine water disposal problems. Both Flexible Polyethylene and Semi-Rigid Kralastic Pipe are available to satisfy a very broad range of applications. Both are lightweight and easy to handle, cut, and join. Made of chemically inert materials, Republic's Plastic Piping is impervious to acids, alkalies, metallic salts, and other corrosive wastes found in mine water. Send coupon for details.

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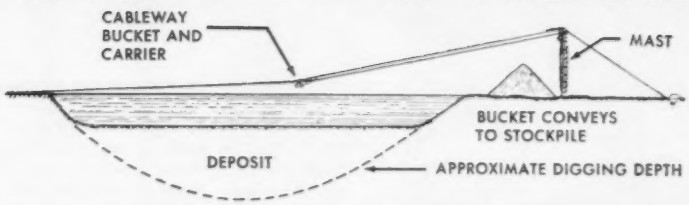
The Best Method for Digging Under Water is a Sauerman Slackline Cableway

. . . R. W. Bisett, Pres., Olean Gravel, Inc.



A Sauerman Slackline Cableway has been excavating material for Olean Gravel, Inc. since 1930. The 1½-yd. bucket has an operating span of 1200 ft., with an average haul of 900 ft. Depth of the pit is approximately 85 ft.

Due to the long haul and digging depth, Olean uses shovels at the shore line to supplement the Slackline and maintain the 200-tph. capacity of their new plant. Mr. R. W. Bisett, President, states:

"No one has yet come up with a better way of getting material from below the water line than Sauerman."

During freezing winter months when the plant is not operating, the Slackline Cableway is kept running to build a stockpile of material. A 110-ft. mast permits building the pile to a height of about 75 ft. All digging, elevating, conveying and dumping operations are handled by the hoist operator. Gravity return of the bucket to the excavation completes the fast operating cycle.

Where long range excavation or deep digging is required, it pays to use a Slackline Cableway. Contact Sauerman for specific recommendations on your job. Catalog C, *Slackline Cableways*, gives more information on this materials handling method.

SAUERMAN BROS., INC. 626 SO. 28th AVE. BELLWOOD, ILL.
Linden 4-4892 • Cable CABEX—Bellwood, Illinois

Crescent Scrapers • Slackline and Tautline Cableways • Durolite Blocks

Minnesota *(Continued)*

and included a load of 44,730 tons carried by the steamer Cosmic, the largest load ever shipped from the Seven Isles harbor.

Great Northern Iron Ore properties trustees predict that domestic iron ore shipments will be at a substantially lower level during the 1958 season. They note the "present' depressed state of the steel industry and the heavier than usual inventories of iron ore in lower lake ports and stockpiles." They also took into account the increasing imports of iron ore: 2,820,000 tons in 1946 and more than 30-million tons in 1956.

The Minnesota Supreme Court has unaminously denied the State's petition for reargument of the Rabbit Lake watercourse case involving the ownership of valuable iron ore deposits. The court held last June that the State does not own the beds of six lakes with ore bodies under them. The court held that the state had not proved that the lakes were part of a navigable, commercial waterway under federal tests when Minnesota was admitted as a state in 1858.

Jessie H. Mining Co., Hibbing, shipped 149,276 tons from its Jessie mine in 1957, 14,098 tons more than in 1956. The mine is located near Grand Rapids, south of PM&Co.'s West Hill mine. Some stripping was done at the Jessie during the winter.

MONTANA

Nancy Lee Mines Inc. of Kellogg this spring will reactivate its silver-lead mine in Mineral County, west of Superior, under a lease agreement with E. G. Smith of Osburn, Idaho. The company has agreed to assist Smith in financing rehabilitation of 3500 ft of adit tunnel and the sinking of a 250-ft, two-compartment vertical shaft to open at greater depth an ore body which has yielded some production in the past. First proceeds from production would go to reimburse the company advances, and thereafter the company would receive a 15% royalty of net smelter returns. Smith operated the property between 1944 and 1950 under a 15% royalty lease. In 1955, after the company had carried on development work for several years, the lease was reinstated, to run to 1962, and Smith then sank a winze to a depth of 80 ft but found it impractical to mine through such a small winze.

Treasure State Uranium Co., in partnership with a group of Canadian engineers, has resumed its unique underground hydraulic mining operation at the old Brooklyn and D-G properties in the Maxville area of Granite County. The mining method, installed and tested last year, involves breaking down a decomposed porphyry dike carrying lead-zinc-silver values with high-pressure streams of water. A pipeline carries the ore by suction and gravity to settling ponds near the mill-site where it is

marcy mills...

"No Compromise with Quality"

YOUR ASSURANCE OF

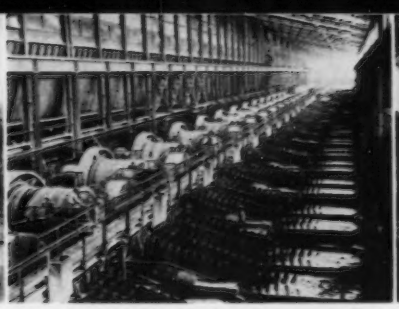
▶ **low net-cost-per-ton grinding**

AND

▶ **long operating life**

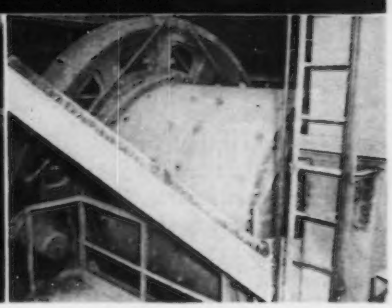
Since 1915...

seven 8'x 6' Marcys, purchased in 1915 by a U. S. copper company, are now being used in a Philippine Island mill. After 43 years these mills are still operating with their original gears.



For 15 Years...

these 10'x 10' Marcys have been operating in a large copper mill. There have been no bearing problems and the original gears are just now being reversed.



Since 1915...

this 8'x 6' Marcy is still working 24 hours per day in a large cement plant after 43 years of dependable mechanical operation.

THE MINE AND SMELTER SUPPLY CO.

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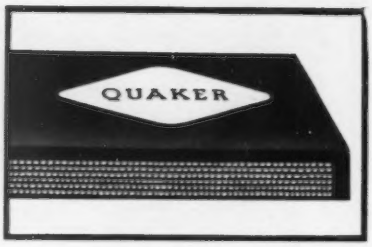
MARCY

Quaker conveyor belting installation used in ore mining.

MORE TONS PER HOUR, PER DOLLAR
Quaker conveyor belting has high abrasive resistance

Quaker conveyor belting is especially designed for carrying highly abrasive materials such as mine ores, trap rock, shales, and machined metal parts. The heavy-duty cover resists sharp abrasion and extra wear caused by material caught between boot pulley and belt. Quaker belting is resilient—engineered to withstand the high flexing of short centers and the tension of long hauls. It is constructed with extra-tough covers and carcass to resist severe impact.

Your Quaker industrial distributor is ready to give you the full story, and to offer valuable assistance on *all* problems involving industrial rubber products.



Cross-section Quaker No. 1 grade conveyor belt; 6-ply N-50 heavy cotton-nylon fabric, skim-coated between plies.

FOR FREE ILLUSTRATED CATALOG

on Quaker belting, containing information on performance, specifications, and sizes, write to QUAKER RUBBER DIVISION, H. K. PORTER COMPANY, INC.; Phila. 24, Pa., or Pittsburg, California.

H. K. PORTER COMPANY, INC.
QUAKER RUBBER DIVISION

Montana *(Continued)*

automatically upgraded by the washing action of excess water flowing over the retaining dikes. Production during test operations last year averaged about 100 tpd with a three-to-four man crew, and extraction costs to the mill-site ran about 50c a ton.

Initial work this year will be the installation of a 14-in. water supply line to replace the present 6-in. line, so that two high-pressure nozzles can be operated at one time. This change is expected to increase production to about 300 tpd. Milling is scheduled to start this summer.

Properties are owned by Black and White Mining Co. and are located seven miles southeast of Maxville.

Day Mines Inc. expects to enjoy considerably improved earnings for the next several years from gold-silver ore which Knob Hill Mines Inc. is extracting from the Gold Dollar Mine near Republic, Wash. The property is owned by Day mines and operated by Knob Hill under lease. As a result of development work on the new 9th and 10th levels last year, ore reserves have been tripled in tonnage and grade.

Day is also enjoying a substantial regular income from its 25% interest in American Smelting and Refining Co.'s lease on the Galena Mine in the Coeur d'Alene District, which is a big silver producer. Operations at the company's base metal mines have been drastically curtailed because of depressed prices.

The Montana Bureau of Mines and Geology, Montana School of Mines, was authorized to join two firms in a project with the dual objective of geologic mapping of possible economic development of the state.

Cost of the cooperative project would be borne principally by the Great Northern Railway and the Pacific Power & Light Co.

NEVADA

Nuclear division of Union Carbide Co. has leased with option to buy 22 claims in Nye county from Mr. and Mrs. Richard McKay and Mr. and Mrs. Lester A. Bisoni, all of Eureka. The company has also located on a block of 64 adjoining claims, making a total of 86 in all. Since there is no organized mining district in the area it is believed the property contains deposits of either vanadium or uranium. Extensive prospecting with modern instruments preceded the land acquisition.

Round Mountain Gold Dredging Co. operated its big dredge at Round Mountain on a seven-day week basis during March and stockpiled material until the mill was ready to start operating. Morrison-Knudsen Co., which had the contract for removing the overburden and digging some of the gold-bearing gravel, has completed its project, and milling operations will start in the near future.

(Continued on p 163)

Longyear mobile rigs moved and set up at new hole in hours

Moving heavy pieces of equipment and erecting tripods is tough work that uses up valuable drilling time. Longyear mobile rigs help diamond drillers avoid this and keep their drills operating more of the time.

Here are three ways Longyear Mobile Rigs save time, effort and money wherever terrain permits their use.

1 Modern steel masts eliminate the need to haul or erect heavy materials for tripods.

2 Pumping unit and other equipment can be mounted on the truck, trailer or jeep, eliminating inconvenient and time-wasting handling.

3 On some truck models, drill and pump may be powered by the truck engine, eliminating the need of separate power units.

Mobile-mounted Longyear drill rigs are engineered to the tough specifications of expert drillers—as are pumps, diamond bits, and all other component parts of Longyear *Coordinated Systems* for diamond drilling.

Write to E. J. Longyear Company, 76 South 8th Street, Minneapolis, for complete details on how Longyear mobile drill rigs can cut costs and save time for you.

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Mining Methods Used in Huge Ripple Rock Blast

IN THE BIGGEST peacetime non-atomic explosion ever set off by man, the worst navigation hazard on the Pacific Coast was blasted into harmlessness April 5 at 9:31 a.m.

A total of 1,375 tons of Nitramex 2H, a comparatively new explosive developed by DuPont which contains 92% ammonium nitrate, tore the tops off the twin peaks of Ripple Rock, 100 miles north of Vancouver, B. C., in the well-travelled Inside Passage to Alaska, and dumped an estimated 155,000 cubic yd of rock into deep water on either side.

Before the blast, the hogback-shaped peaks reached within 9 and 20 ft of the surface at lowest tide near the southern entrance to 2500-ft. wide Seymour Narrows, the current which averaged 10 knots during 250 days of the year creating 40-ft whirlpools that had wrecked more than 100 ships and caused the loss of at least 114 lives in the last 75 years. At low water, even comparatively small ships navigating in the restricted waters of the Narrows could strike the rocks.

After the blast, a hydrographic survey showed a minimum of 40 ft of clear water over the blasted rubble that once was Ripple Rock. Navigation is expected to be safe at all times, instead of during the two daily slack tide periods of an hour or two. No longer will ships line up for hours waiting to go through a slack tide, causing congestion which in itself led to accidents.

With one carefully-planned explosion, the Canadian Department of Public Works was able to accomplish, at a cost of about $3-million what years of nibbling away at the Rock had been unable to achieve. Always before, the peaks had been attacked from the top. This meant that work periods had to be limited to little more than an hour a day, that anchorage of the drilling barges was extremely difficult in the rough water and that spotting holes accurately in varying depths of water also was very difficult.

An underground approach to the job was recommended by the National Research Council of Canada. The Department of Public Works, under the direction of Brigadier Jean-Paul Carriere, chief engineer of the Harbors & Rivers branch, retained Victor Dolmage and E. E. Mason of Vancouver, B. C., as consulting engineers. In 1955, a contract for $2,639,878 was awarded to the Northern Construction Co. and J. W. Stewart Ltd. jointly with Boyles Brothers Drilling Co. Ltd., of Vancouver.

THREE PRIVATE investment groups—American Overseas Finance Co., Bank of America (International), and J. H. Schroder Banking Corp.—and the International Finance Corp. recently signed agreements providing for loans of $6.4-million to finance Empresa Minera de Mantos Blancos, SA. Empresas Sudamericanas Consolidadas, SA and Marvis Corp., SA, owned by the Hochschild group, are supplying equity of nearly $6.4-million for Mantos Blancos. Mine and mill construction have started. When onstream, Mantos Blancos will treat 2,000 tpd, producing 12,500 annual tons of copper. Shown signing the agreement are—seated from left to right—N. A. Bogdan, president American Overseas Finance Corp.; R. L. Garner, president, International Finance Corp.; and Milo Borges, Empresa Minera de Mantos Blancos, SA. Standing from left to right are—P. C. A. Carpenter, vice president, J. H. Schroder Banking Corp.; F. X. Scafuro, vice president, Bank of America; Manfred Wihl, Empresas Sudamericanas Consolidadas, SA. and J. S. Brown, Marvis Corp., SA.

Under this contract, brought to completion by the explosion, a 7x18-ft. three-compartment shaft with cage, skip and manway compartments was sunk on Maud Island, opposite Ripple Rock, to a depth of 570 ft. Conventional mine drilling gear and blasting methods were employed. From the bottom of this shaft, 2,000 ft of 6x7-ft tunnel was driven a minimum of 100 ft under the rock bed of the 325-ft deep channel to a position under the North Rock, with a branch 400 ft to the South Rock. Rock encountered in the tunnel was highly jointed but generally sound, requiring only 170 ft of timbering. Seepage of salt water was minor.

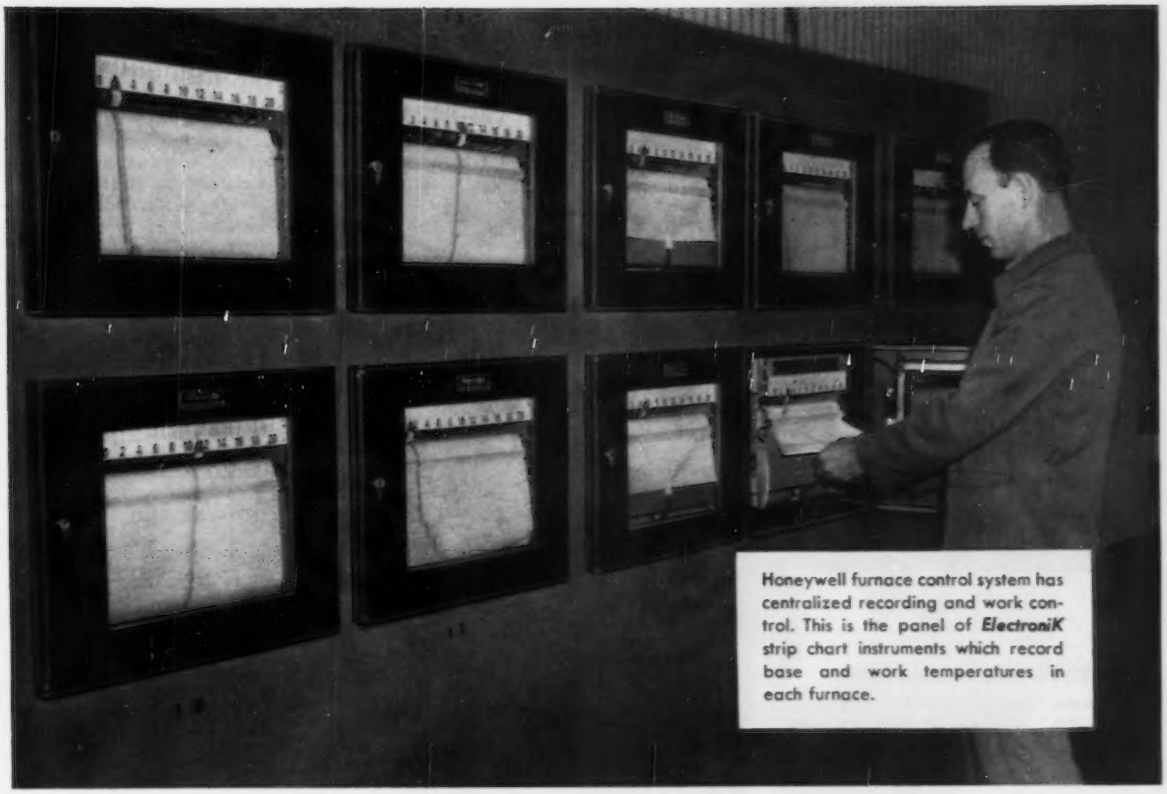
Two 7x15-ft access raises or subshafts, each about 300 ft high, were raised from this tunnel to within 40 ft of each summit. Each raise was equipped with a 25-hp electric hoist to haul men and materials. A station was cut in each sub-shaft at 120 ft elevation below extreme low tide, from which a 5x6-ft sub-level was driven north and south along the long axis of each rock for a total of 521 ft. Boxhole entries and 3x5-ft coyote drifts were driven from this sub-level to within 40 to 50 ft of the rock exterior, honeycombing the pinnacles. These coyote drifts, sloping upward from the sub-levels, were from 70 to 106 ft below the surface of the water at extreme low tide.

Upon completion of the drilling, these drifts were loaded with explosives, in a total of more than 72,000 waterproof, vapor-proof tins, 2 ft long, 5½-in. in diameter and weighing about 38.5 lb. These blasting agents are very insensitive to shock. The loading required three weeks, at the rate of 100 tpd, which meant that the first loads placed were exposed to salt-water seepage for a period of possibly weeks.

After the explosives were in place, the sub drifts and raises were packed with 1,200 yd of sand-bagged gravel, to prevent "blowback." The sub-levels also were filled with stemming for a distance of 50 ft on each side of the sub-shafts, the conveyors also being used for this purpose. After the sand bags had been placed, the 20-ft sections of conveyor were picked up and taken back to the surface.

On Destruction Day, on word from Dr. Dolmage, F. D. Bickel of DuPont closed an electrical switch on Quadra Island, 2500 yd away from Ripple Rock. The electricity ignited four lines of Primacord in the tunnel, burning at 21,000 fps, touching off 2-ft tins of TNT detonators every 20 ft among the explosives in the coyote holes. The use of detonating fuse eliminated worries about stray current leakage from lighting circuits and the possibility of shorts developing because of moisture. The Primacord was protected by sandbagging through the tunnels and strung inside piping through the shaft and sub-shafts.

To make certain that the exploded rock would slip off into deep water on either side of the peaks and not into a saddle between the peaks, initiation of



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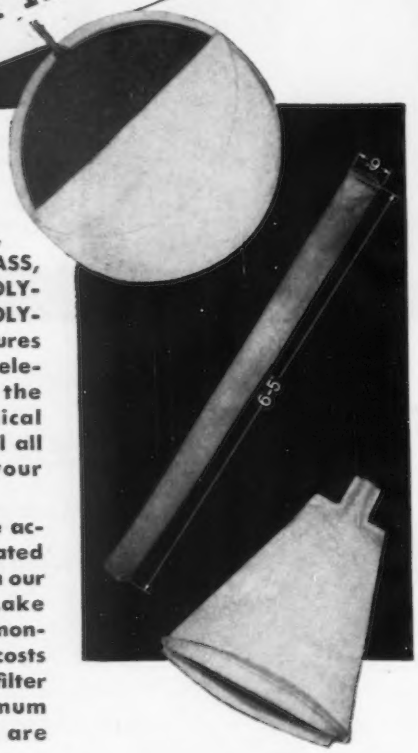

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Ripple Rock *(Continued)*

the blast began at the center of the outside coyotes on the flanks of the rocks. It then progressed toward the ends and by successive coyotes in ascending order to the central coyote at the peak of the ridges. Total elapsed time from the closing of the switch to the end of Ripple Rock was one-tenth of a second. Loading of the explosives varied with the distances the spoil was required to travel under water, and the quantities of rock and depths of water involved.

The blast was set off just a few minutes before low tide, when the water was a maximum of 2 ft above the extreme low-tide mark and when a strong northerly ebb mitigated against any strong tidal wave to the south, where a few homes were located. There are no habitations in practical range to the north. It was believed the tidal wave would be below the high-water mark beyond one mile.

The explosion moved an estimated 520,000 cubic yd or 680,000 tons of rock and water.

Special precautions were taken to protect personnel and workings at all stages of the project. These included the emplacement of steel emergency doors in both sub-levels, which would be closed automatically by rising water, thus preventing the flooding of the main raises and tunnels. Remotely-controlled air-operated flood control gates were installed in each box-hole entry, so that any or all of these could be isolated from the rest of the workings if an excessive flow of water were encountered.

All headings were preceded by test drilling to discover abnormalities of ground and water flows before such were encountered. The practice during the driving of the tunnel, for example, was to drill a pair of diamond drill holes ahead of the tunnel face on either side and on the same bearing. These two holes were kept at least 100 ft ahead of the tunnel face at all times, one driven as a core hole to provide evidence of the nature of the ground and the other as a coreless hole. The locating of each subshaft was preceded by the drilling of a group of cored holes directed to the peak of each rock, and stopped 30 ft short of the surface indicated by soundings.

From the sub-levels, 140 diamond drill and percussion drill holes were drilled an average of 100 ft through to the sea to find the outline of the rock and check soundings made with an echo-sounding device in 1944 by the Canadian survey ship *William J. Stewart*. These drillings were decided upon when the soundings were found to be inaccurate. The echo-sounding device reflected gentle slopes with all practical accuracy but failed to report the sharper topographical features. The peaks of the Rocks turned out to be much narrower than indicated by the hydrographic survey and drillers broke through into the sea while surveys showed they still had 25 ft to go.

After each drilling reached the sea, the steel was retrieved, broken down and stowed away by two or three drillers. The hole then was plugged, 20 to 30 ft

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A combination of quality features makes Roeprene® Parallel Twin Mining Machine Cable different and better. Some of these features may seem like small details . . . but, taken together, they figure *big* in terms of easier installation and maintenance, and valuable *extra* service life. Flexible Roeprene Parallel Twin Cable is built to take tough treatment!

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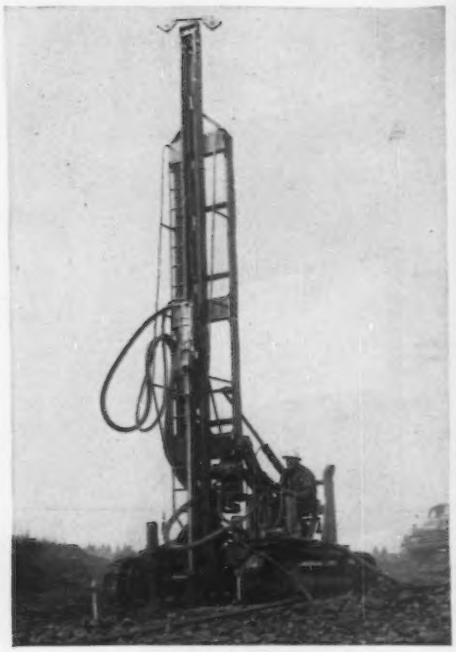

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SECTIONAL DRILL RODS—highest quality—shot-peened and carburized to stand down-the-hole gaff longer.

RING SEAL SHANKS—replaces old-type water swivel without adding additional length to drill.

COUPLINGS—extra long threads—made for longer drilling life.

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Ripple Rock *(Continued)*

back from the breakthrough, with a device improved by Charles Phillips, master mechanic for Northern Construction Co. Device is a rubber cylinder which, by means of an internal screw, is shortened and thickened until it becomes immovable in the hole. The screw is actuated by a tool at the end of the drill rods.

Forced ventilation was supplied to all workings, according to conventional mining practice. During the tunnel driving, a 6000 cfm fan was used for exhausting for a short interval after each blast, and then was switched to blowing for the balance of the cycle. Air was supplied by a Canadian Ingersoll-Rand Imperial No. 10 compressor delivering 1,000 cfm at 100 psi.

Most of the test drilling was done with a 1 7/16-in. Boyles Brothers VEG diamond drill, at lengths up to 160 ft., but some 2½-in. percussion drilling also was done to make the best use of available personnel. Canadian Ingersoll-Rand JR-38 jack drills with standard Copco integral steel were used with a Little Mancha Trammer for sinking, drifting and raising operations. CIL 40% and 75% Forcite was used for blasting. Scrapers moved debris from the coyote holes and sub-levels to slusher hoists in the sub-shafts and battery-operated locomotives hauled the mucking cars to the shaft.

Nevada *(Continued)*

Consolidated Eureka Mining Co., with lead-gold property in the Eureka district, has resumed shipment of ore to the smelter of United States Smelting, Refining & Mining Co.

James E. Hogle, Salt Lake City, president of the mining firm, reports that:

"Since the end of 1957, practically all effort has been concentrated on a development and exploration program. A vertical winze has been sunk 110 ft to the 750 ft level from which a cross cut is now being driven to a projection of the main ore zone. It will take another 30 days to attain this objective," Hogle said.

"A drift on the 500 level has been extended to get under the north ore shoot and this face is now in ore. A drift is also being driven on the 650 level to explore the possibilities of this ore shoot going down to that level. There have been minor showings of ore in this face," he said, adding that "shipments of ore will be resumed during April."

Consolidated Eureka reported net profits of $26,486 for the year 1957 compared with a net of $107,382 in 1956. The figures are without provision for depletion.

The firm shipped 3,431 dry tons of ore with a gross value of $319,436 last year. In 1956 the company's shipments were 4,010 dry tons at $451,835.

American Potash and Chemical Co. has completed expansion of its research laboratory in Henderson, following several weeks of work, and company officials say it is now one of the most

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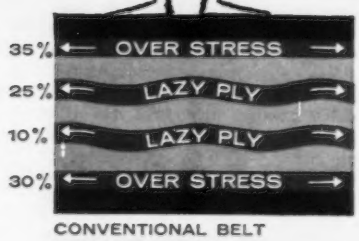

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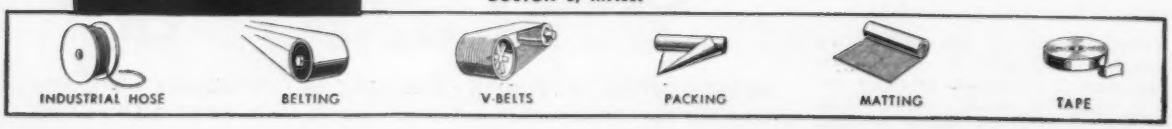

These High Strength Steel trailers were built by the Marion Metal Products Company, Marion, Ohio. Use of 12-gage **USS Cor-Ten** Steel, instead of 10-gage carbon steel, reduced weight 23%.

High Strength Steel trailers increase payloads 50%

at Saxton Coal Corporation, Petersburg, Indiana

When Saxton Coal Corporation moved their strip mine location, the dump trucks had to travel twice as far to unload at the transfer tipple. To maintain their daily loading schedule they had to build a bigger fleet, or increase the payload of the trucks they were using—without going over the legal weight limit. Part of the route was on state highways.

They decided against more trucks and additional operating expenses, and solved their problem by purchasing High Strength Steel trailers that could be handled by their present tractors. "We increased the payload of each truck more than 50%," says General Manager Darwin C. Youngs, "and we haven't exceeded the legal weight limit on the roads we travel."

Payload is increased with High Strength Steel construction because High Strength Steel is much stronger than carbon steel. Trucks and trailers can be made lighter, and *the weight saved goes into the load instead of the carrier.*

High Strength Steel has greater resistance to atmospheric corrosion, impact and wear than structural carbon steel. It needs less maintenance and it lasts much longer.

United States Steel produces three brands of High Strength Steel—COR-TEN, MAN-TEN and TRI-TEN. Each has its own characteristics that make it ideal for certain applications in trucks and trailers. USS "T-1" Constructional Alloy and USS Stainless Steels are also available. If you want more information about how these steels can help your trucking operations, write United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

USS, Cor-Ten, Man-Ten, Tri-Ten and "T-1" are registered trademarks

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SUPER MATERIAM IGNIS TRIUMPHANS

J. K. SMIT & SONS, INC.
HOME OFFICE AND PLANT
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Nevada *(Continued)*

modern research facilities in the country. American Potash and Chemical now has four such research centers, the other three being at Trona, Whittier, and Los Angeles, Calif. Peter Colefax, president of the firm, says that the company's expenditures for research during 1957 represented 3.9% of the sales.

Construction of the new Eagle-Picher diatomaceous earth processing plant is progressing rapidly at Colado, east of Lovelock, and much of the steel framework is now in place. Foundations have been completed as well as the bin into which trucks from the Trinity Mountain mine will dump their ore. The work is being done by Kaiser Engineers Division, Henry J. Kaiser Co. The job will have cost $2-million when completed next August.

Machinery to be installed includes a 9 x 120-ft rotary kiln, blowers, cyclones, traps and an air heater. The plant will have a capacity of 36,000 tons of natural and calcined filter aids annually. Kaiser Engineers performed exploratory and geological work on the Eagle Picher diatomaceous open pit mine site 25 miles northwest of the plant in order to design the treatment plant.

Wah Chang Mining Corp. had a delegation of mining men and engineers led by Clarence Hall in Nye County during March, conducting an examination of fluorspar ground near Beatty. They made their headquarters at the Mizpah Hotel in Tonopah, and reports say the firm is considering moving the big Tempiute tungsten mill to the Beatty area if prospects warrant. The Tempiute mill has been idle since the Wah Chang mine there was closed in 1957 when the Government subsidy for tungsten ended.

Eureka Corp. has "pulled the pumps" on its big "TL" shaft of the Eureka district, Eureka County.

The shaft was sunk in exploration of lead ores in the historic district after the famous "Fad" shaft was abandoned.

Company officials at Eureka gave no explanation for the closure of the property. A reduced crew of 15 miners had been drifting on a lead ore body at the time the pumps were pulled in mid-March.

But they and a spokesman in Salt Lake City for United States Smelting, Refining & Mining Co. confirmed that negotiations had been re-opened for changes in the lease that Eureka Corp. has on properties in the district from Richmond-Eureka Mining Co. The latter firm is 59% controlled by USSR&M.

The Eureka Corp. project was Nevada's largest active lead-gold prospect.

NORTH CAROLINA

Bear Creek Mining Co. advised North Carolina officials March 26 that it has changed its mind about bidding for a lease on phosphate deposits beneath state-owned lands in Hyde and Beau-

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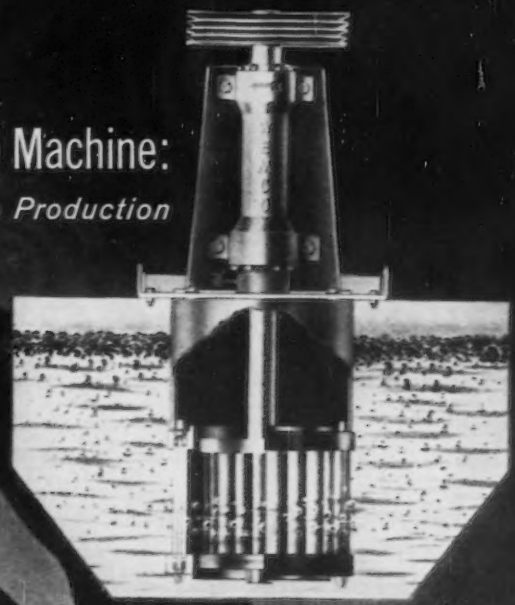

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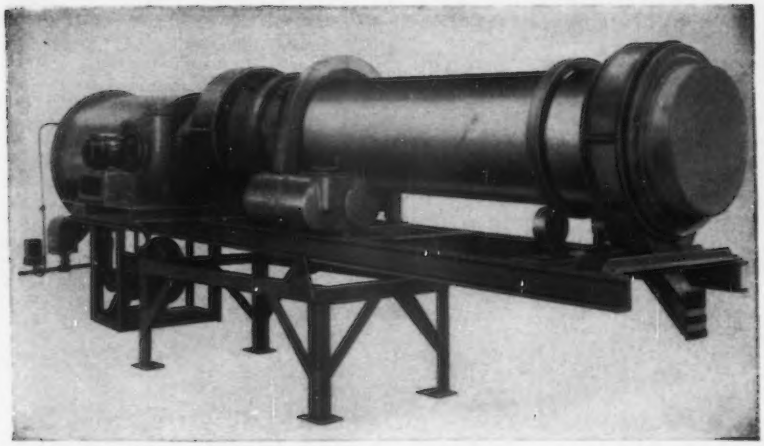

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The Ruggles-Coles Pilot Plant Dryer is designed especially for laboratory use or for small capacity unit operations requiring a continuous or intermittent drying step. Each unit:

- Is mounted on a structural steel base.
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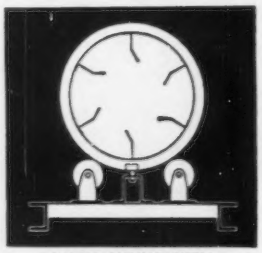
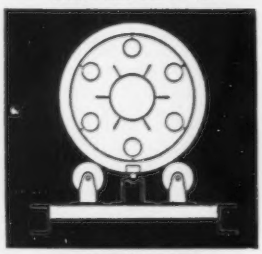
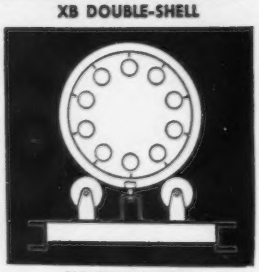
- Provides for easy changing of shell rotation speed or shell slope.
- Is available in stainless steel or other corrosion-resistant materials.
- Requires only fuel supply and power connections to be placed in operation.
- Is easily moved from place to place.



XH-XF SINGLE-SHELL



XB DOUBLE-SHELL



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(3) XC steam-tube indirect heat dryer. Can be connected to any available steam supply or furnished with a 3-HP steam generator. Bulletin AH-473

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North Carolina *(Continued)*

fort Counties and that it will not bid again for the lease when the State Conservation and Development Board met April 13-15.

The company was the only bidder for lease on 60,000 acres of state-owned submerged land in the Pamlico and Pungo Rivers when the C&D board met last summer, and the board recommended that it be given the lease. Later, however, after a complaint arose by General Crude Oil Co. that it had not been given adequate opportunity to enter a bid, the N. C. Council of State declined to approve the lease agreement and ordered the C&D board to reopen bids on the phosphate lands.

No one but Bear Creek ever has entered a bid on the lands and its action in announcing withdrawal from the picture leaves the state without a bidder at the moment.

Sam Brewer of Carolina Aluminum Co. at Badin, has located a gold ore vein near New London, whose ore reportedly has been assayed at an average of $19.95 per ton, and is granting operating rights to mining interests.

W. Rae Deal, mining engineer of Little Switzerland, has reported discovery of what is believed to be an extensive vein of massive, perfectly transparent quartz on the property of J. Quince Collis at Little Switzerland.

OHIO

Battelle Memorial Institute has embarked on a two-year study of the "rare earths" with a view to determining new uses for 15 individual and combination elements.

Seven major producers of the rare earths are sponsoring the research. They are Davison Chemical Co., Division of W. R. Grace & Co.; Electro Metallurgical Co.; Heavy Minerals Co.; Lindsay Chemical Co.; Mallinckrodt Chemical Works; Michigan Chemical Corp.; and Molybdenum Corporation of America.

Three different Battelle teams under direction of Dr. John Foster will attack the problem. Dr. Horatio H. Krause Jr. heads the team of chemists; James F. Miller, the physicists, and Dr. George W. P. Rengstorff, the metallurgists.

The 15 so-called rare earths are not rare at all, explained Richard J. Anderson, Battelle geologist and liaison agent between his firm and the sponsoring companies.

"For example," he said, "there is more cerium, one of the rare earths, in the earth's crust than there is antimony, tungsten or mercury. There is a tremendous potential supply of the rare earths."

UTAH

Bear Creek Mining Co., domestic exploration subsidiary of Kennecott Copper

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Two heavy-duty deep-hole drills now available with standard-neutral-reverse rotation for use with coupled steel: CP-400DR, 4" cylinder bore, 2½" holes to 50 feet; and CP-450DR, 4½" cylinder bore, 3" holes to 75 feet. *Chicago Pneumatic Tool Co., 8 East 44th St., N. Y. 17, N. Y.*

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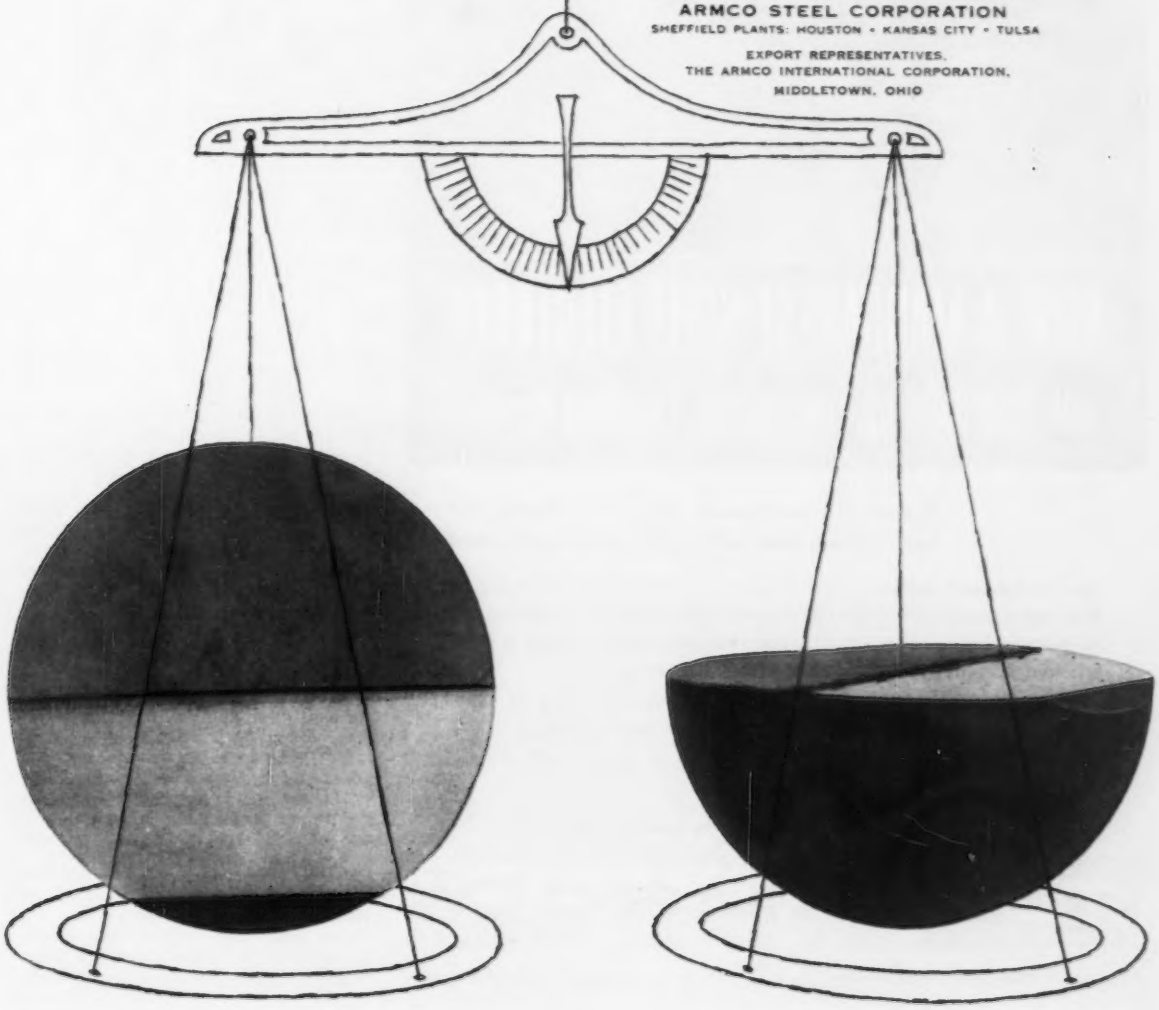

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Utah *(Continued)*

Corp., has reduced exploration work at its Tintic district prospect in Utah to one shift per day.

This will not affect the over-all plan of prospecting by core drilling and drifting—it will just take longer to accomplish, according to Cecil Fitch Jr., president of Chief Consolidated Mining Co., Eureka.

The Chief, along with the Tintic Group of companies, (Tintic Standard, et al) own the claims on which Bear Creek is working.

Through exploration and development, Standard Uranium Corp., Moab, was able to improve its ore reserves and grade during 1957 somewhat over levels at end of 1956, according to William R. McCormick.

The firm also made final payment on the purchase of the Big Buck properties in the Big Indian District of San Juan County.

However, during last year as a result of shipment of larger amounts of lower grade, which otherwise would have been lost in present development of the properties, a smaller number of tons of lesser value ore was sent to mill than in 1956, McCormick reported to shareholders.

Isbell Construction Corp., Reno, Nev. has completed removal of 750,000 yd of overburden from the famed Happy Jack uranium mine in the White Canyon district of San Juan County, in conversion to open pit.

The firm is operating the property under contract to the Texas Zinc Minerals Co., owner of the mine and operator of a mill at Mexican Hat.

A. L. Hayes, Grand Junction, Colo., Texas Zinc president, said the open cut mine would be worked on one-to-one ratio and that except for a few areas, the rock was well consolidated.

It is estimated as Isbell starts full-scale ore production utilizing a three yard shovel, that the depth of the cut from top of the bluff is about 140 ft.

Ultimately, as the mine on the rim of White Canyon is deepened, it will have to be reconverted to underground operations, Hayes said.

United Park City Mines Co., one of the few remaining lead-silver-zinc producers in Utah, reduced its net loss last year to $88,199. This compares with a net loss of $123,936 for year 1956, said S. K. Droubay, general manager and John M. Wallace, president, both of Salt Lake City.

Long-range development work was abandoned during 1957 because of the decline in lead-zinc-copper prices. Working force was cut 20%.

UPC was able to replace one ton mined for each ton produced during 1957, by virtue of new ore developed on short range exploration in Ontario section of the Park City district property.

Lee Aikin, Corpus Christi, Tex. and Salt Lake City, has purchased control of Minerals Refining Co., Salt Lake City.

The Texan came to Salt Lake City in connection with acquisition of the Bamberger Railroad Co. (short line between

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Utah *(Continued)*

Ogden and Salt Lake) by Murmanill Corp., Dallas, in which oilman Clint Murchison held commanding position. Murchison is not associated in the Minerals Refining control, which now looks toward perfection of metallurgy leading to exploitation of low-grade beryllium ores and a process for making silica-free, artificial cryolite.

Officers and directors of the Minerals Refining Co. now include Patrick James, vice president of Chase Manhattan Bank, and Cyrus Polly, partner in John C. Legg & Co., New York investment bankers, Aikin said.

A new world's record for driving an 18x24 ft tunnel was established at the new 12-million ton ore haulage project of the Kennecott Copper Corp's Utah Copper Division, Bingham Canyon.

Paul C. Gunn, project manager for Utah Construction Co., said the U-C miners drove the tunnel 1,363 linear feet in 26 working days during March.

They also lined the tunnel at the same time with 4,810 cubic yd of concrete.

The U-C crews broke the previous world record last September and have maintained near records in intervening months. Between September and April 1, they averaged 45.5 ft daily.

The 18,000 ft tunnel has been advanced to 11,623 ft with 180 men working around the clock on a six-day week.

Gunn said that the seven straight record months of driving the tunnel means the project should be completed this November, rather than in June of 1959, as expected—or seven months ahead.

WASHINGTON

Washington Mining Corp. is producing cinnabar at one mine in the Green River Canyon, six miles from Enumclaw, expects to have a second in operation within a year.

Secretary of the corporation is Ron Ljungahl, Enumclaw, who discovered the ore deposit four years ago with Laurence Berkshire of Palmer, now vice president in charge of exploration.

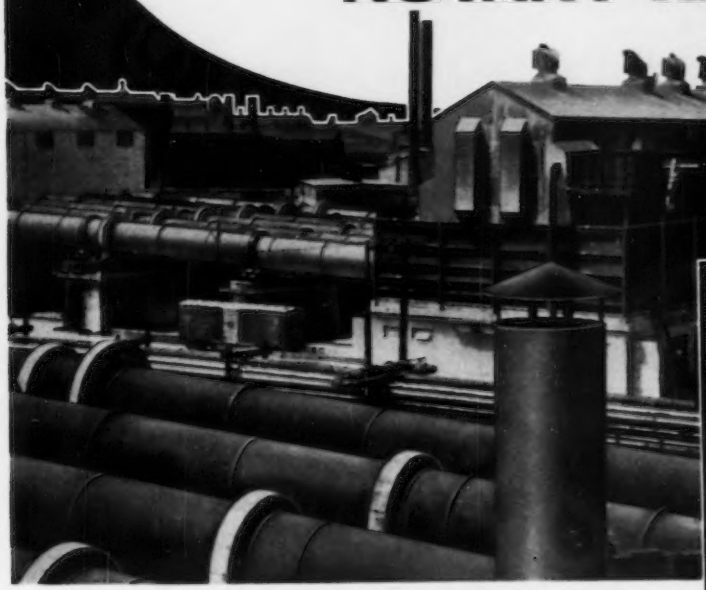
The richest ore, reportedly running as high as 1000 to 1,200 lb of mercury per ton, is being processed in a pilot plant with a one-ton retort. Early samples indicate that the ore will yield up to 24 lb of mercury to the ton.

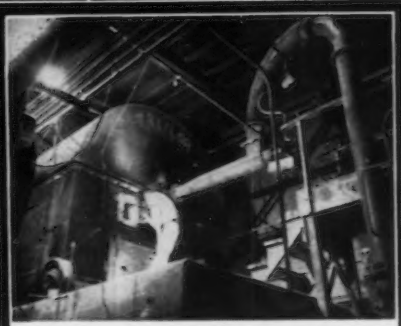
Burton Avery, former superintendent of the Bonanza mine in Sutherline, Ore., will take over this month as superintendent of the first mine, known as the Royal Reward. He will succeed Ljungahl, who has been acting as mine superintendent.

At Royal Reward, two shifts of miners have bored an access tunnel 36 ft into the hillside, and work is about to begin on a shaft 270 ft deep to the orebody. At the 250-ft mark, the miners will branch out with 1,000-ft-drifts in several directions. Work was scheduled to start April 15 on an access road to the second mine, the Cardinal Reward.

Company officials describe the Royal Reward as the "only producing mercury mine in Washington state."

Traylor-MADE ROTARY KILNS





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Hundreds of Traylor Rotary Kilns are in daily use by industry, reflecting the sound design and rugged dependability of Traylor machinery. Traylor kiln shells are fabricated with quality steel plate. Traylor features the full-floating type of tire with special mounting holding the tire securely in place but permitting it to float free of the shell as it contracts and expands. Still another outstanding feature of Traylor Rotary Kilns are the drives with the main pinion of cast, forged or tool steel with low addendum machine-generated teeth and mounted on an adjustable base. For more information. write for Traylor Bulletin #1115.

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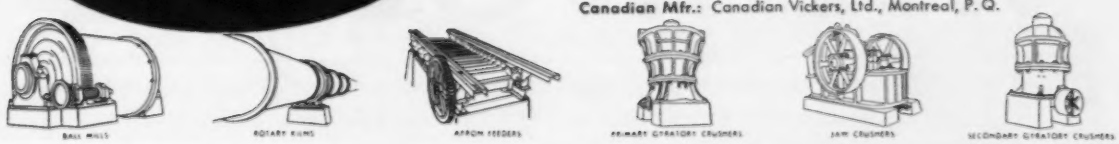

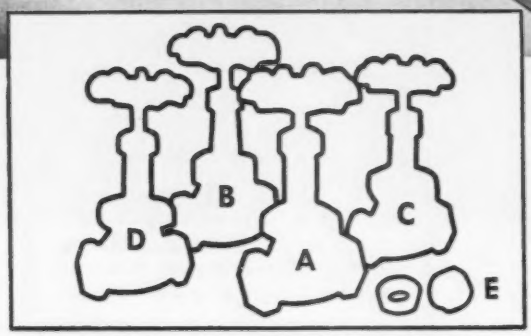

A — No. 225P.....350 WSP 550F, 1000 WOG
B — No. 260P.....300 WSP 550F, 600 WOG
C — No. 245P.....200 WSP 550F, 400 WOG
D — No. 237P.....150 WSP 500F, 300 WOG
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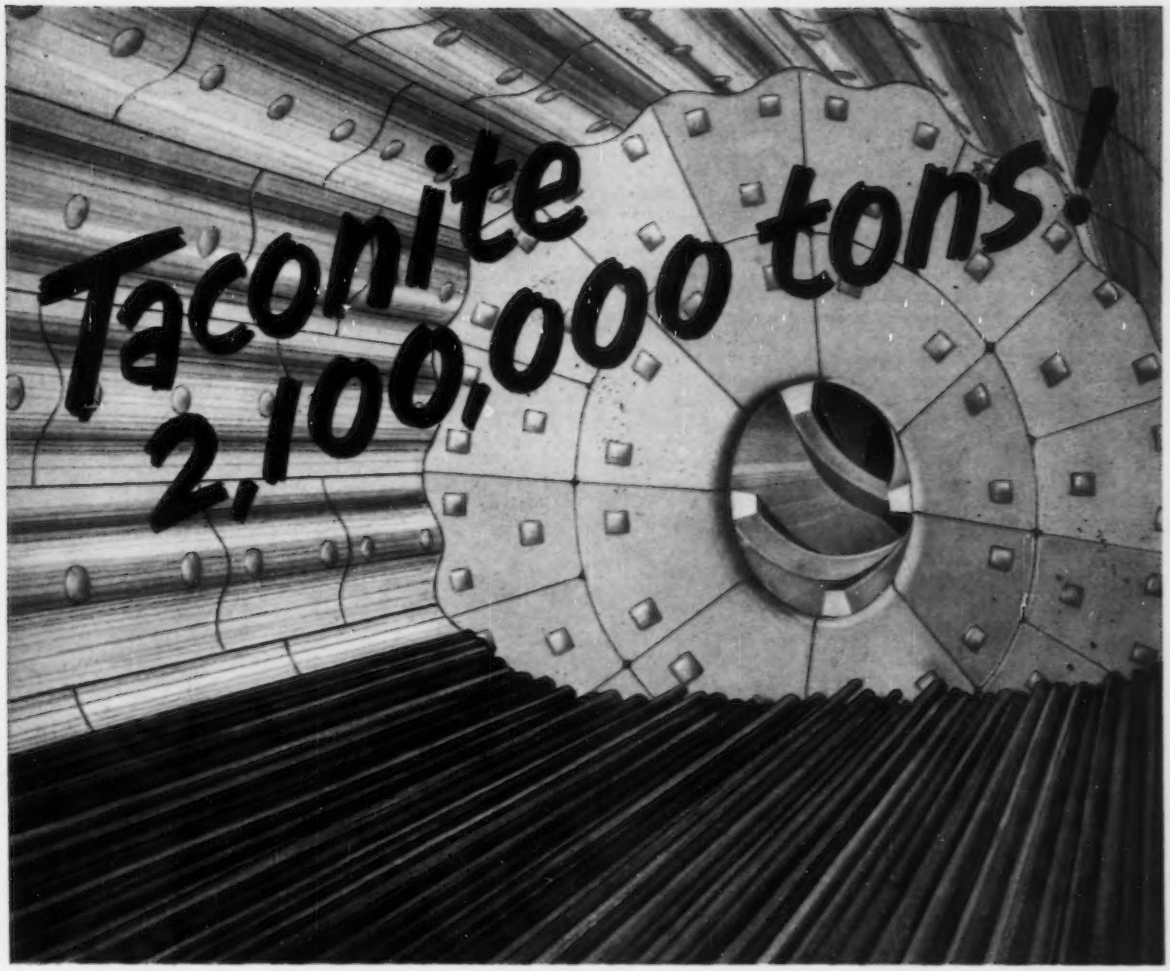

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Taconite! Hardest, most abrasive ore the mining industry handles. It chews up grinding equipment and faces tough competition from other iron ores. Per ton costs of processing taconite are a number one problem.

*ABK Metal liners in the rod mills of a large Minnesota taconite producer using 4 in. rods have improved production runs and brought new economy to taconite grinding. Long-wearing ABK Metal liners have ground more than 2,000,000 tons. Costs per ton of taconite ground are 48% under the best of five other materials used (see box). Taconite milling costs are down, runs are longer, fewer replacements are needed.

Taconite mine operators agree, "If you can mill taconite you can mill anything." ABK Metal shell and end liners help get the job done at far lower cost. Wherever extreme abrasion is a problem ABK Metal parts have consistently outperformed other "abrasion resistant" materials. For information on how you can cut costs in your plant with long-wearing ABK Metal parts, call your local Engineered Castings Division representative.

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Addition of Mill Capacity Pleases Plateau

THE DOMESTIC URANIUM INDUSTRY for the most part was agreeably surprised by the proposal of the Atomic Energy Commission to add another 3,300 tpd of concentrator capacity to the domestic scene.

Many uranium men, because of the insistent reiteration of the statement in recent months that the U. S. had adequate capacity already, were fearful that AEC would recommend no additions in areas where ore supply considerably outruns concentrators.

And despite the general satisfaction about the decision to increase, there still were some areas of complaint.

In its study, the commission emphasized the Nov. 1, 1957 date, basing mill capacity on ore reserves as of that date. This could be important, inasmuch as some firms continue to establish additional ore reserves.

And it is thought that in areas where more than one mill might be built (Gas Hills), the company or group of companies with the largest uncommitted ore reserve as of Nov. 1 would naturally be given the biggest slice of the mill tonnage allocated for the particular district.

In the Gas-Hills-Crooks Gap District in Wyoming, allotted 1,700 tpd of new mill capacity, the AEC said there were 4,777,00 tons of 0.24% uranium ore controlled by independent producers who had only 654 tpd capacity assigned them on custom basis. Unless new capacity is granted, added the AEC, the independents would not be able to complete run of their ore until August, 1978.

Allan Jones, manager of the Grand Junction Operations Office of AEC, said the Commission fully expected to grant the extra 1,700 tpd capacity.

He said AEC was "ready to deal" now with various proposals for mills in the area.

Unfortunately, there is now a sort of "hiatus" insofar as the operators with proposals before the AEC are concerned.

Of the "independents" without mill capacity in this district (the existing mills are not given much consideration in their expansion proposals) all have bids in for considerably more tonnage than considered necessary by AEC.

So the bet is that two or more of the main groups might join hands to build a 1,500 tpd mill.

Front runners in the mill picture remain Vitro Minerals Corp. with Atlas Corp.'s Lisbon Uranium Co.; Federal Uranium Corp.; and Globe Mining with Union Carbide Nuclear.

It is possible that some 200 tpd would be assigned to the Lucky Mc Uranium Co. mill to accommodate Phelps Dodge Corp.'s uranium reserves held with Wyoming Uranium Corp. PD previously announced association with Lucky Mc in a proposed 1,000 tpd expansion of the Lucky Mc mill.

The other 1,500 tons of capacity in the district could be shared by the three independents. There is considerable discussion that Union Carbide might withdraw from its joint proposal with Globe on account of the recommendation made for capacity servicing Karnes and Duval counties, Texas. Here the AEC proposed 600 tpd of capacity to serve 1,713,000 tons of 0.25 U_3O_8 ore. The only proposal before the AEC for a mill in this district is from Southern Chemical Corp. with Union Carbide.

In any event, so far as Wyoming is concerned most operators are convinced their price is going to be in the $8 a pound range for concentrates. Thus a mill of only 500 tpd capacity does not look as attractive as a 1,800 tpd mill built by a merger of interests among a couple of firms with proposals currently before the AEC.

Here is the breakdown on other areas for which AEC recommended mill expansion.

North Dakota-South Dakota (lignites). AEC proposes a 600 tpd mill to treat uranium-bearing reserves 0.20 U_3O_8. International Resources Corp., which is backed by citizens in the region, has the only proposal.

In the Austin, Nev. district, Apex Mining Co. has the only proposal for a mill where AEC says a 200 tpd concentrator is needed to treat 215,000 tons of 0.18 U_3O_8. This finding had the industry remarking that either Apex must be given a good concentrates price or the "pickins' will be mightly slim on that grade of ore."

AEC has identified three applicants for mills in the Front Range area of Colorado where its survey established reserves of 140,000 tons running 0.40 U_3O_8 or better. Seeking a 200 tpd mill, as proposed by the AEC, are Golden Cycle Corp. with Newmont Mining Corp., (joint); Cotter Corp. and Uranium Extraction Corp., Denver, Colo.

Cotter Corp. already has been given a permit by AEC to build a pilot plant in which the ores could be tested for amenability. They are of a high grade

TWENTY TONS of 22% uranium ore is shown arriving at Grand Junction, Colo. If accepted under AEC conditions, it will qualify Lisbon Uranium Corp., for the long-standing $10,000 bonus offer. Shown, left to right, are: P. B. Martin, assistant counsel, Grand Junction operations office, E. A. Youngberg, assistant manager at GJOO; A. P. Kibbe, Lisbon president; A. E. Jones, manager of GJOO; M. N. Gaines, manager for Lucius Pitkin, Inc., ore buyers for AEF; and John T. Sherman, assistant director for raw materials, AEC.

Lisbon Uranium Tries for AEC's Ore Bonus

LISBON URANIUM CORP. of Salt Lake City confidently expects to pick up the coveted $10,000 bonus that Atomic Energy Commission has offered, without takers, for last 10 years to a miner who could produce 20 tons of 20% ore.

The offer expired at midnight, April 11, 1958. Before the deadline Lisbon delivered the 20 tons of about 22% U_3O_8 to the compound of the Grand Junction Operations Office of the AEC at Grand Junction, Colo.

The offers for the bonus were made in Circulars One and Two.

While many miners and a few companies with high grade in their deposits have sought to qualify for the bonus, few had consistently high grade ore and hand picking was not worth it.

Anyway, the AEC pays only $1.50 a lb for the U_3O_8 in Circulars One and Two. It pays $3.50 a lb in Circular Five.

Thus a miner shipping for the bonus would actually make about $1,800 less, including the $10,000 bonus, than he would under Circular Five prices—and hang the bonus.

However, Paul B. Martin, assistant legal counsel for the AEC at Grand Junction, is seeking an interpretation of the expired bonus offer. It is possible, it is reported, that Lisbon might get both the Circular Five prices as well as the $10,000 bonus.

(This stems from a view that price established in Circular Five superseded the lower prices in Circular One and Two.)

Ore for the bonus qualification drive came from the Nixon claims of Lisbon Uranium Corp. in Utah's Big Indian district.

The high grade was initially found by drilling from the surface. "We did no hand picking on this ore," said A. P. Kibbe, Lisbon president, "it was all in one body." He said there also was additional very high grade ore in the area. However, Lisbon's Ike-Columbia ore bodies generally averaged around 0.35%.

Big ropes for high-speed hoisting system. The shaft served by these hoists goes into an iron-ore mine to a depth of 2200 ft. It is equipped with a man-and-materials cage and two high-speed 20-ton skips. The cage operates at 1450 ft per min; the skips at 2500 ft per min. An interesting feature of the shaft is its circular shape, designed to offer maximum resistance to rock pressure.

The hoists for cage and skips are rigged with Bethlehem ropes of the flattened-strand type. For the cage hoist (foreground), 1¼-in. rope is required. The skip hoist uses the 2¼-in. size.

Bethlehem Steel Company, Bethlehem, Pa. On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

Mill depots and distributors from coast to coast stock Bethlehem rope for the following industries and numerous others:

MINING • QUARRYING • CONSTRUCTION • EXCAVATING • PETROLEUM • LOGGING • MANUFACTURING

BETHLEHEM WIRE ROPE

BETHLEHEM STEEL

Plateau *(Continued)*

but complex nature. However, Cotter has not yet started on construction of the pilot plant.

All new mills granted would run through the 1966 program under the contracts, the AEC said.

The AEC has not actually closed the door with all finality on further concentrator expansion beyond this level. But a meeting (April 11) of the Uranium Institute of America with Jones and John T. Sherman, assistant director of division of raw materials, failed to stimulate much enthusiasm from the agency about opening the door wider.

A. P. Kibbe, president of Lisbon Uranium Corp., Salt Lake City, proposed that the Institute name a special committee which would be charged with keeping in touch with AEC on mill contracts and changes in policy. These changes could then be readily transmitted to Institute membership. However, the AEC officials objected this would place committee members in a preferred position on intelligence over would-be-competitors.

Market disagreement characterized the views independent mine owners in Utah White Canyon district had on the milling situation in this area.

"Milling capacity is sufficient to permit the treatment by mid-1964 of all ores developed prior to Nov. 1, 1957, at an economic mining rate if arrangements can be made to provide a larger percentage of the mill capacity for custom ores," said AEC.

Texas-Zinc Minerals Corp. has the only mill, a 775 tpd concentrator at Mexican Hat, Utah, of which 155 tons is available for custom ores.

AEC lumps the Monument Valley area into the district, but subtracts reserves of Vanadium Corporation of America's Monument No. 2 mine which ships to mill at Durango, Colo. It gives the district 1,869,000 tons of 0.28 U_3O_8 ore.

Dr. A. E. Flint, Salt Lake City, vice president and chief geologist for the Radium King Mines, Inc., said his shipments already had been reduced from 6,000 tpm to 2,000 tpm to Mexican Hat.

He said only the AEC could make the "arrangements" whereby Texas-Zinc would run more custom ore. The AEC representatives at the Uranium Institute session at Grand Junction confirmed they were in negotiations at present on extension of the Texas-Zinc contract into the 1966 term and that added custom capacity was being discussed at the same time.

There was one complaint that the Kerr McGee mill at Shiprock was not accepting additional custom ore shipments.

And AEC officials confirmed there would be no added capacity granted in the foreseeable future for the Uravan Mineral Belt area.

Some mill men also objected that in case of Salt Lake and Big Indian districts in Utah, the issue was not adequacy of tons through mill each day but pounds yearly which AEC proposes to buy in concentrates.

Extremely high grade ore is forcing some Utah mills to deliver pounds of concentrates at a much more rapid pace than projected. Hence, there's a good chance these mills will be without contracts and some custom shippers without mills earlier than planned.

WYOMING

A British company has taken an option to purchase a group of uranium claims in the Gas Hills for nearly $600,000 and a royalty.

Camp Bird, Ltd., will pay $100,000 and a 16% royalty to Two States Uranium Co. if it exercises an option on five Bountiful claims and the Blackstone No. 51 claim.

A similar option has been obtained for a group of Bountiful claims owned by Valley Dean Corp., for which Camp Bird would pay about $447,000 and a 16% royalty.

Two Lander couples have sold their interest in the Robin Hood claims 1 to 7 to U. S. Steel Corp.

The claims are in the South Pass City area where U. S. Steel's subsidiary, Columbia-Geneva, is contemplating construction of a processing mill and development of vast low-grade ores.

Slake lime

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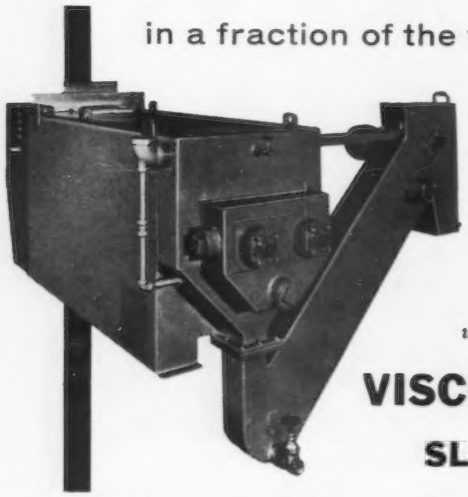

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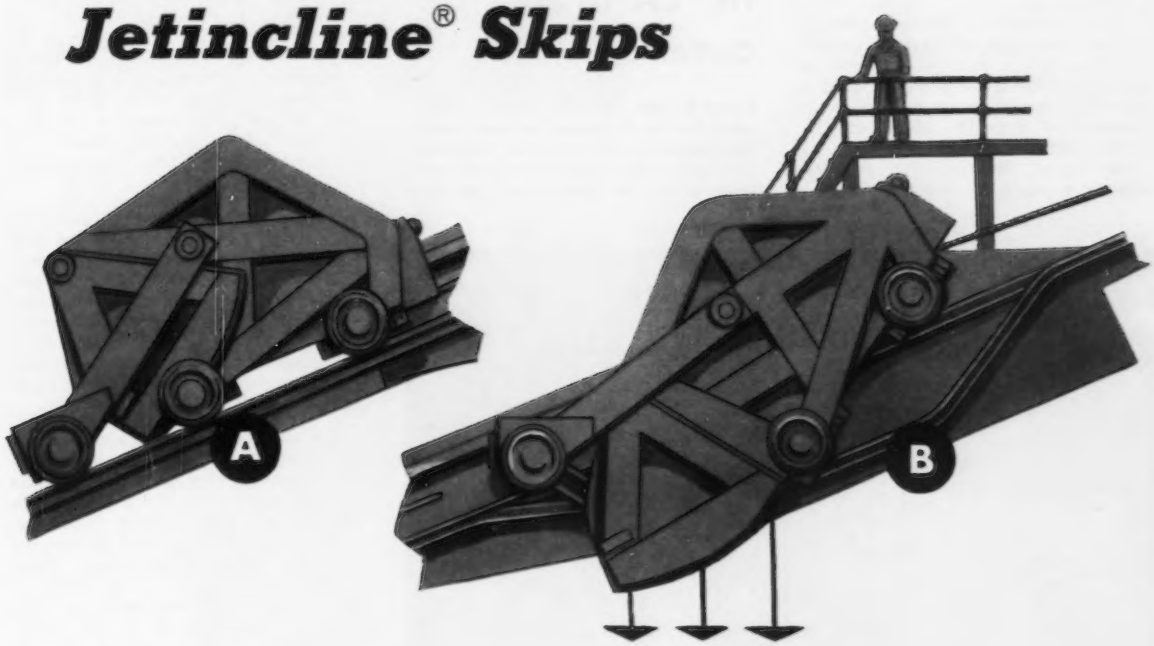

The JETINCLINE Bottom Dump Skip has all the advantages of Lake Shore's famous "Jeto" skip—fast, clean dumping and lasting construction. Capacities are available up to forty-five tons.

Dumps clean every trip. As the skip approaches the dumping station, the narrower rear body rollers follow the lower rails of the scroll and the skip is actuated. As this occurs, the rear door opens and the ore flows out unrestricted. The stubborn, sticky ore in bottom corners is immediately cleaned by the following loose ore.

Dumps fast every trip. Because the skip body rotates a limited amount during dumping, it therefore transfers minimum stresses to the headframe and can be dumped faster and more smoothly than any other type of skip.

Rugged construction. High manganese wheels of the JETINCLINE skip are equipped with tapered roller bearings and the axles are spring mounted on three point suspension directly to the body of the skip. This arrangement allows the highest concentration of weight and strength to be placed where it is needed most, in the body. In the largest skips the body is reinforced with sections that run to sixteen inches in thickness. In addition, all skips are equipped with heavy cushioned liners inside.

For increased production, many mines have converted to Lake Shore "Jeto" and JETINCLINE bottom dump skips. Their faster dumping and lasting construction are your assurance of more production at lower cost. For full details see your Lake Shore representative or write our Engineering Division, Iron Mountain, Michigan.

LAKE SHORE, Inc.

Lake Shore Engineering Division

IRON MOUNTAIN 1, MICHIGAN

Wyoming *(Continued)*

Reynolds Mining Corp.—a subsidiary of Reynolds Metals Co.—announced it has exercised its options on 7300 additional acres in the Lake Desmet area, including the Lake itself.

Announcement was made by Walter L. Rice, president of Reynolds Mining and vice president of Reynolds Metals Co. He said the property—adjacent to large coal deposits—is being acquired as a potential power site for possible future expansion of Reynolds' Aluminum Production facilities.

Rice stated, however, that no plans have been made for construction of a plant and that there is no indication as to when construction might begin.

IN CANADA

ONTARIO

Upper Canada Mines is starting on deepening its No. 1 shaft at its gold producing property in the Kirkland Lake area. The work follows development of good grade ore on the lower levels and establishment by diamond drilling of continuation of major ore structures below the present bottom level. The mine last year turned out record production of 49,153 oz gold, up from 43,757 oz in 1956.

Stanrock Uranium Mines, which started production at its Elliot Lake uranium property in March at a rate of 1,000 tpd, is making steady progress in its objective to reach capacity operations of 3,000 tpd by summer. Underground development is being pushed with initial work in low grade fringes of the main ore zone. As experienced elsewhere in the camp, grade has been running above drill indications.

Paymaster Consolidated Mines has started work in preparation for the sinking of the No. 6 winze to open two new levels at 4,225 and 4,375 ft at its gold producing property in the Porcupine area. Crosscuts are to be driven approximately 1,000 ft on each level towards the projected downward ore extension. The preparatory work is expected to be completed by July.

Algom Uranium Mines, a major uranium producer in the Elliot Lake area, completed one-fifth of its total sales contract of $206,910,000 in 1957. This was achieved from 12 months' production from the Quirke mine and 10 months' production from the Nordic mine. About 1,120,000 tons of ore was milled at Quirke and 870,000 tons at Nordic. Ore reserves at the end of the year were estimated at 29.2-million tons. Of this total, fully and partially developed reserves at Quirke amounted to 1,409,000 tons averaging 2.31 lb uranium oxide per ton, and at the Nordic 2,237,000 tons averaging 2.65 lb per ton.

Campbell Red Lake Mines enjoyed record production at its gold producing mine in the Red Lake area in 1957. Grade of ore continued to show increase as development proceeded on the lower levels. Output for the year totalled 144,530 oz gold, up from 132,719 oz in 1956. Average grade of ore milled was 0.613 oz per ton as against 0.576 oz in the previous year. Ore reserves were maintained at 1,043,500 tons with average grade showing increase from 0.649 oz per ton to 0.662 oz.

Kerr-Addison Gold Mines, Canada's largest gold producer, marked up another record year in 1957. Production moved up from $16.2-million in 1956 to $17.4-million. Ore reserves at year end totalled 13.1-million tons, exclusive of more than 500,000 tons indicated below the 3850-ft level. This latter tonnage, indicative of increase of grade at depth, averages 0.54 oz per ton, compared with over-all average of reserves of 0.314 oz. Depth development at the big Larder Lake gold producer is progressing steadily.

Reflecting decreased demand for nickel, International Nickel Company of Canada is moving to curtail its nickel production by 10%. The curtailment will cut nickel output by about 2,500 tons per month and will also mean a reduction of about 1,000 tons of copper monthly. In 1957 the company's nickel production reached

Packer-Ette at United Electric Coal Company's Fidelity Mine packing Bemis-made waterproof (laminated) bags. Packer-Ette is equally efficient in packing polyethylene bags or tin cans.

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Packs Ammonium Nitrate Explosive With Greater Speed, Economy, Accuracy, Cleanliness

- 50 percent increase in production
- Two-man operation, instead of three
- Accuracy to 3 ounces on a 33-lb. bag
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- Complete cleanliness

These five major benefits were reported by United Electric Coal Company when it began packing its formulation of ammonium nitrate explosive on a Bemis Packer-Ette bag packing machine.

The Packer-Ette maintains a steady production of six bags or cans per minute, with no delays for hand-tamping or cleaning up overflow (there is no overflow with Packer-Ette), and no guesswork on weights.

Write or phone us for *complete* information about this new, efficient, and economical method of packing ammonium nitrate explosives.

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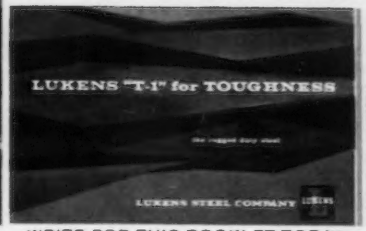

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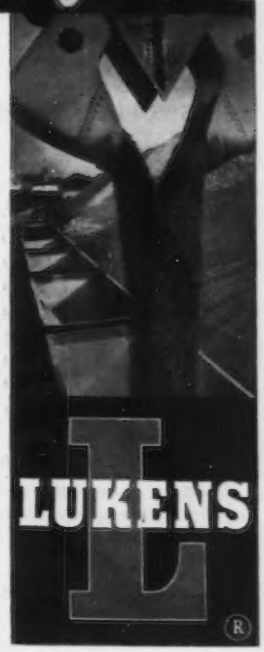

■ Wherever rock and gravel, coal and ores come in violent contact with machine and equipment parts, Lukens "T-1" steel—*especially extra tough 321 min. BHN quality*—fights back at wear and abrasion with spectacular success.

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Far stronger for its gage than conventional steel, it requires less metal to do equivalent jobs. It remains tough even at sub-zero temperatures.

Contact your nearest warehouse listed below, or write Manager, Marketing Service, 142 Lukens Building, Lukens Steel Company, Coatesville, Pennsylvania. Ask for special bulletin, *"Lukens 'T-1' for Toughness."*

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"Not merely to sell; but to serve . . . not only to make good steel products; but to make them still better . . . not only to fulfill today's requirements; but to anticipate tomorrow's—these are the principles that constantly guide CF&I."

G. F. Kranz
President

Grinding Mill Bulletin #4

In line with our company policy—service as well as sales—CF&I is presenting this series of ads on grinding ball rationing in the makeup charge. We trust that these ads will help grinding mill operators—by providing information that will help increase the efficiency and productive capacity of their ball mills.

General Method of Rationing the Makeup Charge

These facts have been outlined in previous ads in this series: (1) that determining the optimum size assortment of grinding balls for a makeup charge is a practical means of improving mill operation; (2) that the best makeup charge of one-size ball should be established before a rationed makeup charge is attempted; (3) that over-size ball additions are preferable to under-size additions in general, although both reduce mill efficiency; (4) that radical changes in the size of the balls to be added is not good practice. Now let us look at methods that are regarded as good practice.

If it is determined that there is a shortage of small balls in the seasoned charge, part of the makeup charge may be made up by smaller balls of one or more sizes. If there is a problem of tramp oversize in the grinding circuit, a portion of the makeup charge may be replaced by a ball of larger diameter.

In many cement plants, the seasoned charge in the mill contains too many balls that have worn to small and irregular shapes—so that they give ineffective contact. These small and "cull" balls take up space that could be better utilized by larger spherical balls which would grind more effectively. In order to increase the ratio of larger balls in the charge, the mills are periodically dumped; the charge screened; the larger balls returned to the mill; and new balls are added to make up for those cull balls which are removed.

Steps In Working Out The Ball Ration

Complete records should be kept:

(1) so that the throughput of the mill, ball wear and power consumption are known. It is also well to record liner wear, although this requires observation over a long period of time.

(2) of feed, discharge, classifier overflow, and classifier sands screen analyses. Classifier sands size structure will give indications as to whether smaller or larger balls in the charge will give better results.

(3) to show the effect of any change in ball addition on: the mill throughput, power consumption per ton and ball wear in pounds per ton. These changes will affect the size structure of the mill discharge as well as the classifier overflow and sands.

Before it is assumed that the full effects of a change in ball additions have occurred, the ball wear pattern should be given time to reach its new equilibrium. This will involve the amount of time required for the old ball charge to be entirely replaced by the new charge. For example, if the ball load in the mill is to be maintained at 100,000 lbs., and 1000 lbs. of balls are added per day to maintain that ball level, it is reasonable to assume that more than three months will be needed in which to complete the modified ball charge.

If the new makeup charge is one that would increase the rate of comminution of the ball mill, and *if* the new ball charge reaches its equilibrium *without* an increase in feed rate: the new charge will *not* show an increase in throughput; the steel consumption will be too high—due to steel on steel wear; and steel consumption per ton of ore ground will be unnecessarily high. Therefore, to prove the value of a change in ball ration, it is important that care be exercised to keep the mill feed at capacity at all times.

Rules, studies and formulae for analyzing classifier sands data, mill feed or dumped ball charges, are discussed in the article on which this ad is based.* Too much space would be required to cover this material here. However, CF&I's mining department engineers are thoroughly familiar with good practices in grinding ball operations, and are ready to help you with your specific problems. CF&I is also ready to provide special analysis steel grinding balls which will give you maximum production efficiency in your grinding mill. CF&I Grinding Balls are available in all standard diameters from ¾" to 5". They are carefully inspected throughout production and immediately prior to shipment to ensure that they are free from surface pits, circumferential ridges or other surface defects. You'll find them ideally suited to helping you work out the correct ball ration for your specific operations.

**For a reprint of the article on which this series is based, please write on your company letterhead to: Mining Supply Department, The Colorado Fuel and Iron Corporation, P. O. Box 1920, Denver, Colorado.*

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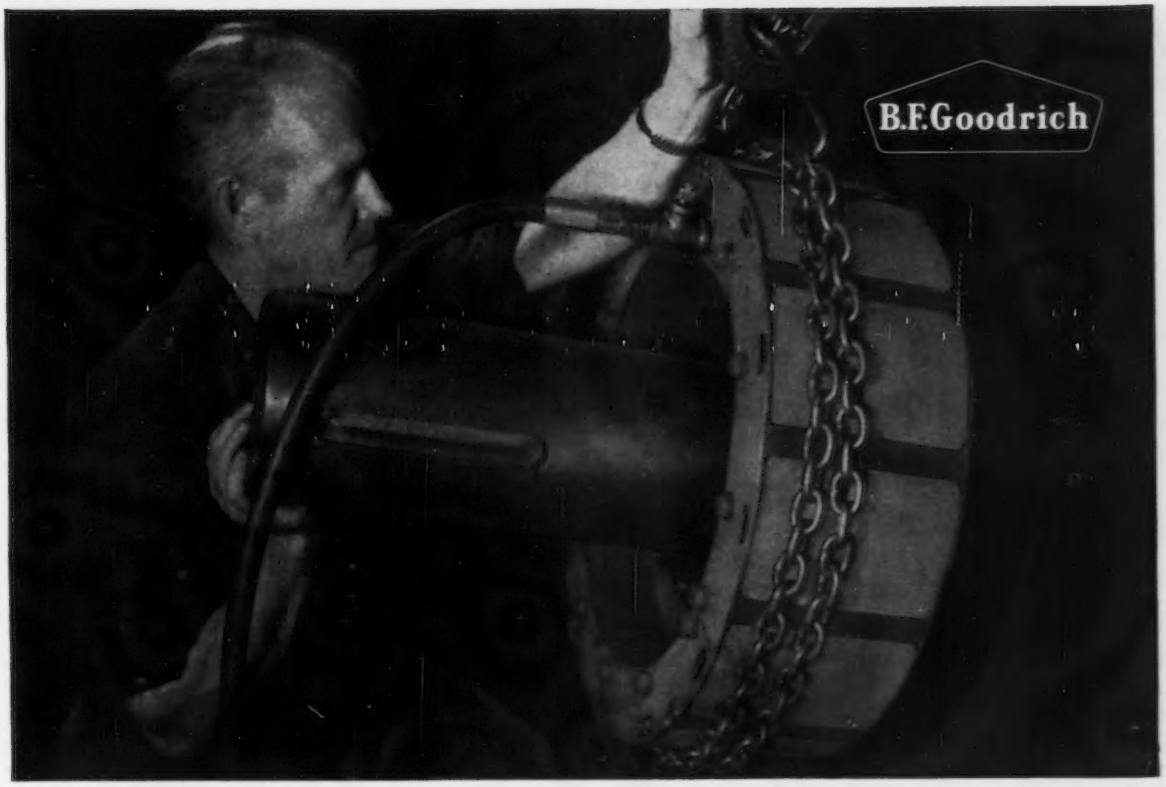

New B.F.Goodrich Hi-Torque Brake STOPS TWICE AS FAST

Continental-Wooldridge self-propelled Dumper and Scraper Models CWD-214, CWD-321, CWD-221, CW-215, CW-220, and high-capacity tractor-drawn Scrapers, have capacities up to 30 yards struck and 39 yards heaped. 22" x 7" B. F. Goodrich Hi-Torque Brakes provide maximum stopping power.

HERE'S THE ONLY heavy duty brake that will give you the reserve stopping power you need for today's new, larger off-road equipment. In one operational test, the B. F. Goodrich Hi-Torque Brake stopped a popular 24-ton capacity truck at a rate of 18 Ft/sec^2. This same truck, equipped with conventional two shoe brakes, achieved a deceleration rate of only 7 Ft/sec^2.

Full circle stopping power is the main reason for the superiority of the B. F. Goodrich Hi-Torque Brake. Its exclusive design gives more lining contact area than any other drum brake. An hydraulic expander tube actuates each of 12 shoes—allowing them to follow drum eccentricities with equal lining pressure. This gives a smoother, faster, safer stop with much less chance of fade.

What is even more important to most operators, the B. F. Goodrich Hi-Torque Brake is easy to service. It requires no lubrication—and lining changes can be made with standard hand tools. On many jobs where ordinary brakes require excessive down time, the Hi-Torque Brake will let you operate with *no* down time.

Find out how your operators can speed up cycle time and still maintain better braking control. Free booklet—The B. F. Goodrich Hi-Torque Brake—gives specifications and test results. Write B. F. Goodrich Aviation Products, a division of The B. F. Goodrich Company, Troy, Ohio.

B.F.Goodrich Hi-Torque brakes

Ontario (*Continued*)

an all-time high with deliveries totalling 290-million lb, compared with 271.3-million lb the previous year. Tonnage of ore produced from the company's Sudbury mines exceeded 16-million tons.

QUEBEC

First drilling in a new copper-gold zone at Portage Island (Chibougamau) Mines on its Chibougamau area property has indicated strong structure. Core length intersections ranged from width of 15 ft up to 64 ft with grade of better than 2% copper suggested. The zone has been drilled only along a length of 800 ft and is still open at both ends along strike. Drilling is continuing.

Underground development at the Chibougamau area property of Copper Rand Chibougamau Mines is being continued this year on a restricted basis following decision to defer plans for production due to depressed condition of copper market. The work is designed to test further ore potential at depth. To the end of 1957 revised ore estimates were given as 824,000 tons grading 2.83% copper in the main Eaton Bay zone to 525 ft, excluding 252,000 tons averaging 2.07% copper estimated to be tied up in a surface pillar. In the South Eaton Bay zone a further 543,000 tons averaging 2.87% copper was outlined above the 525-ft horizon.

Raglan Nickel Mines has made an early start on resuming work at its nickel-copper concession in the Wakeham Bay-Cape Smith belt in Ungava. Diamond drilling is being resumed on its find located last year. Three holes were put down at that time near the close of the season. The drilling was along a length of 635 ft and returned an average of 3.03% nickel and 0.54% copper across 54.6 ft. A second zone on the same strike and also open at both ends was located. Best intersection on this zone in x-ray drilling was 11.78% nickel-copper across 16 ft.

Mattagami Syndicate is carrying out an extensive program of geophysical exploration and diamond drilling on its properties in the Mattagami Lake area. Last year the Syndicate discovered a large base metal deposit on its Watson Lake property in the area. A total of 21,000 ft of drilling in 37 holes indicated over 14-million tons containing an estimated average of 230 lb zinc, 13 lb copper, 1.11 oz silver and 0.06 oz gold per ton. The deposit has yet to be delimited.

NEW BRUNSWICK

Nigadoo Mines is making good progress in underground development at its base metal property located some 12 miles northwest of Bathurst. Shaft sinking has been completed to below 900-ft depth with levels established at 175, 300, 450, 600, 750, and 900 ft. Bulk sampling tests averaging between 100 to 150 tpd are being run in the former Keymet plant located nine miles from the mine. Results are said to be satisfactory.

Operations at Brunswick Mining and Smelting Corp. in the Bathurst area have ben suspended. Shaft sinking and laboratory test work were continued until March 31 of this year. During 1957 the No. 2 production shaft was sunk to depth of about 800 ft and an intensive program of flotation research was carried out. A practical flowsheet for the design of a production mill was devised and site plans, plant layout comparisons and estimated costs for construction of tidewater concentrator and auxiliary buildings were drawn up.

BRITISH COLUMBIA

Mines Minister Kenneth Kiernan has presented amendments to British Columbia mining legislation which guarantee renewal of mining leases, under certain conditions, to give lease holders a certainty of tenure.

The amendments do not return the old crown grant system, but represent an effort to meet some of the protests from mining interests since the crown grant system was ended a year ago.

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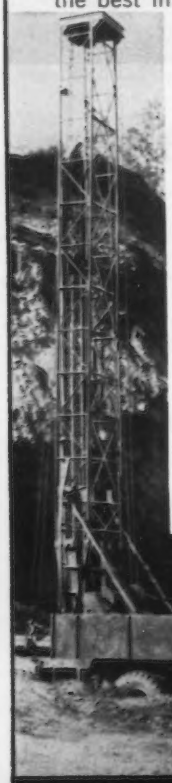
Telephone: Beaver Falls, Pa. 69, or Kearny, New Jersey, 2-2600

For 6 ½" blast holes, our experience indicates that we can drill them faster and at a lower cost because we have combined the best in applied drilling engineering.



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- Timken 6½" carbide insert bits
- International Harvester Truck
- Cummins Diesel Engine
- Gardner-Denver WBJ Compressor, 600 CFM at 100 PSI
- Keystone Franks Rotary Mole Drilling Machine

While we DEMONSTRATE what we can do, we cut your drilling costs at the same time. Phone or write us for a DEMONSTRATION on your quarry, mine, road or construction job.

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MOLE DRIL DOWN THE HOLE GUN with Timken threaded carbide insert rock bit

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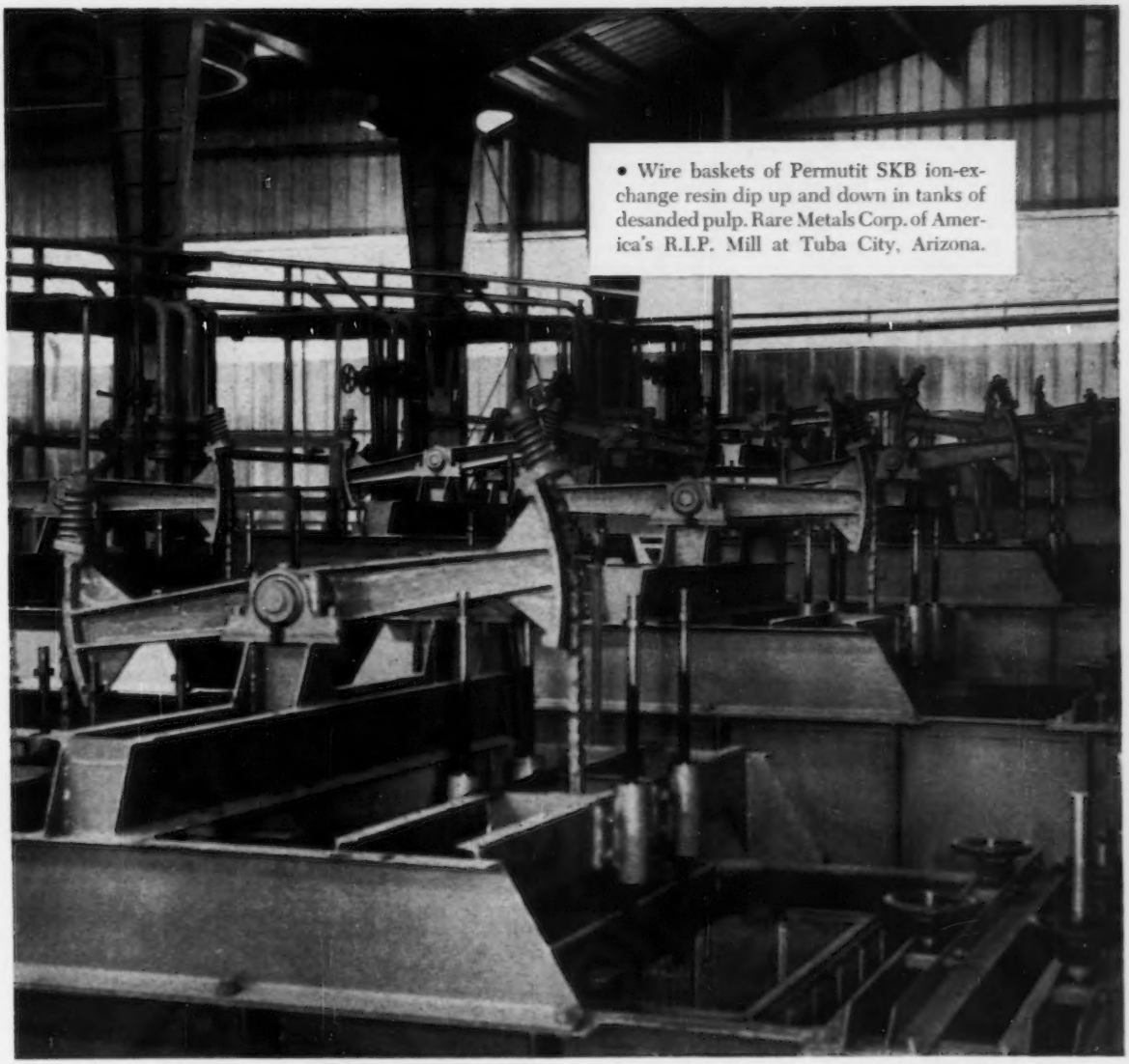

• Wire baskets of Permutit SKB ion-exchange resin dip up and down in tanks of desanded pulp. Rare Metals Corp. of America's R.I.P. Mill at Tuba City, Arizona.

How Rare Metals licks a "tough" uranium pulp with Permutit SKB resin

• Rare Metals' ore produces a hard-to-handle clay slime pulp difficult to contact with resin. This pulp is also high in molybdenum and other ions that make it necessary to "restore" the resin periodically with a caustic-nitrate solution that is hard on most resins.

In spite of these difficulties, Permutit SKB is showing fast loading and high capacity . . . as high as 3½ or 4 lbs. U_3O_8 per cu. ft.! Resin losses are low. And production exceeds the design capacity of the plant!

A number of R.I.P. Mills use Permutit SKB for these same reasons. It was specially developed for R.I.P. extraction. It has high uranium capacity and fast elution, for higher production and lower precipitation costs; and it has excellent durability to resist chemical or physical breakdown.

Permutit SK (finer mesh than SKB) offers the same advantages in ion-exchange columns.

We'll supply full details and samples to help you evaluate Permutit SK, SKB or other ion-exchange resins. Write: The Permutit Company, Dept. EMJ-5, 50 West 44th Street, New York 36, N. Y. or The Permutit Company of Canada, Ltd., Toronto 1, Ontario.

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Water Conditioning
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B. C. *(Continued)*

Under the year-old legislation, there were two types of leases: one for five years, as a "holding" lease; the second for 21 years as a production lease.

Under the new amendments there will be only one type of lease, and it will be for 21 years. There will be a guaranteed renewal for another 21 years if the lease has been in production for any period in that 21 years; and a renewal "may" be granted if certain development work has been done, and fees paid, during the first 21 years.

The requirements: work valued at $4 an acre and a fee of 50 cents a year for each of the first 10 years: then work valued at $6 an acre and fees of $1 an acre for the next 11 years.

There can be up to 16 claims (each with a maximum of 1500 by 1500 ft) which equals 51 acres in each lease.

When claims are staked, there must be $100 worth of work a year per claim to hold it. There is no limit to the number of years such claims can be held.

In the amendments last year, it provided that a claim holder had to go to lease within five years; that proviso is ended.

Bethlehem Copper Corp. Ltd. has granted Asarco extension of two additional years for development of Highland Valley copper properties before a production decision is made with Asarco agreeing to spend at least $500,000 during each of the two years.

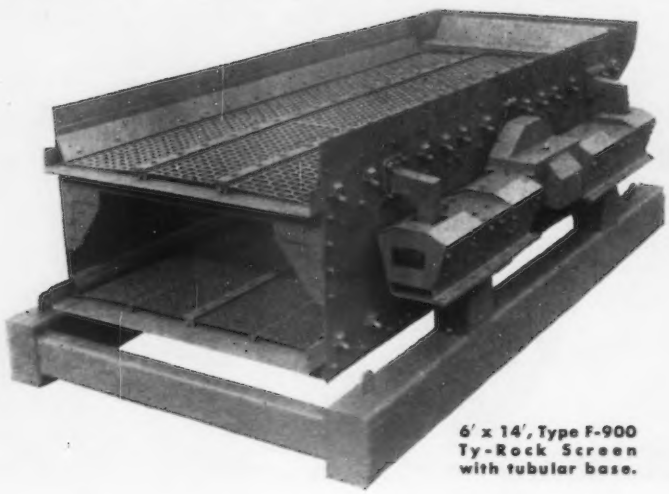
Granduc Mines Ltd. has abandoned indefinitely development work at its copper property on the Leduc glacier, 25 miles north of Stewart.

Reeves MacDonald Mines, Ltd., of Remac, said in its annual report that 1957 net income totaled $10,535 compared with $202,299 for the previous year. Jens Jensen, Spokane, president of the firm, said the company had lower earnings despite the fact that it mined and milled about 5,000 more tons of ore last year than in 1956. He said that reduced metals prices were responsible for the lower earnings.

Production at the Reeves MacDonald mine totaled 405,531 tons of ore which contained 27,378,166 lb of zinc, 7,922,971 lb lead, 150,152 lb cadmium and 26,155 oz silver. Net smelter returns totaled $1,953,538.

The report said that development work included 3,873 ft of drifts, 2,830 ft of raises and 50,457 cubic ft of station work during the year. Mine shaft was extended 503 ft and it reached a slope distance of 1,065 ft below the main haulage level.

TY-ROCK SCREENS



6' x 14', Type F-900 Ty-Rock Screen with tubular base.

For TOP Performance

The balanced circle-throw action of the Ty-Rock plus the full-floating action on large shear type resilient rubbers enables this screen to separate material with unequalled speed and effectiveness.

The Ty-Rock wastes no power in useless, harmful racking of buildings or supporting members. It delivers all of the intense power to the job of stratifying and separating the sizes.

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IN LATIN AMERICA

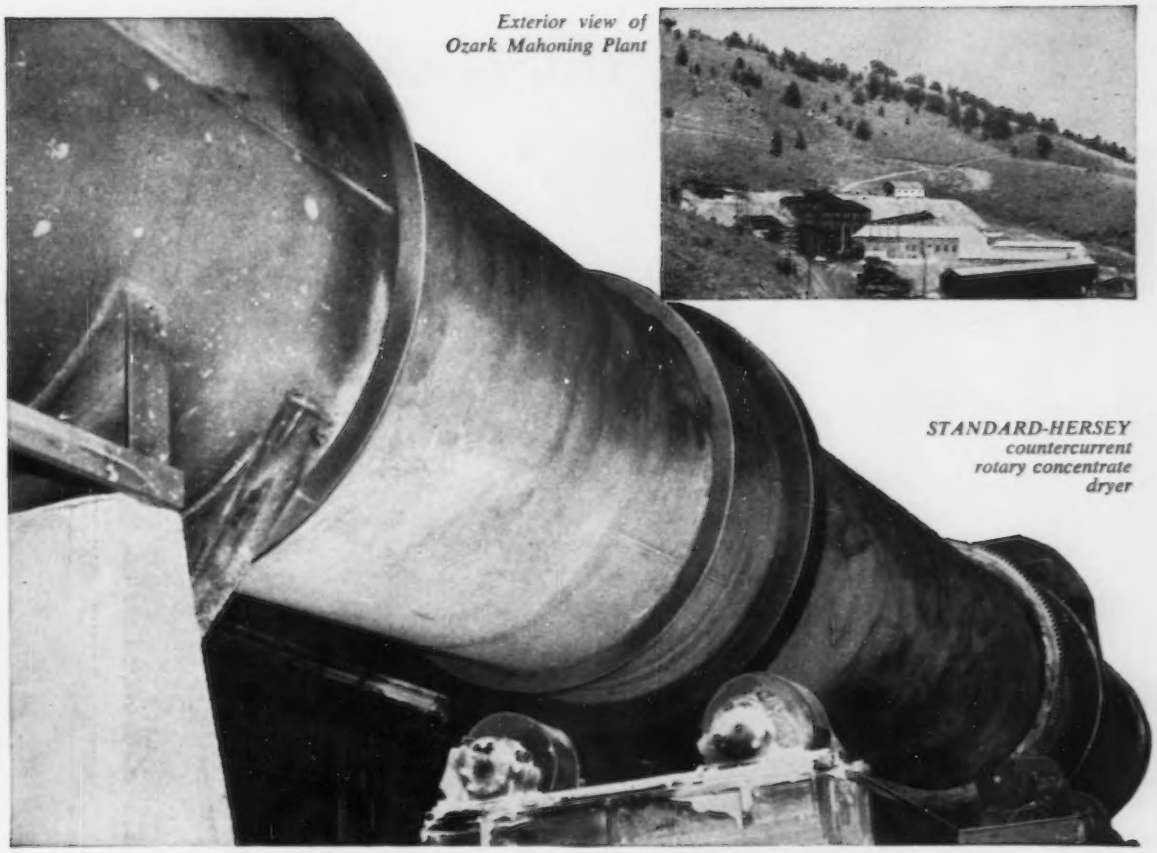
CHILE

Jacob Isbrandtsen, president of the shipping company that bears his name, J. MacGardner, vice president of J. Henry Schroeder Banking Corp. and Leslie Geiger, of the Canadian Foreign Ore Development Corp. have paid a two week visit to Chile to visit the iron and copper mines which are being developed by Compañía Minera Santa Fe as well as the mechanized ore-loading wharfs which are being built at the ports of Caldera and Chañaral to reduce the present high cost of loading iron ore at these ports.

Organizations, which these financiers represent, furnished the capital for the development of the medium size iron mines which Compañía Minera Santa Fe controls.

Sociedad Minera Brillador Ltda. has just completed the installation of a 12-ton contact sulphuric acid plant of German design at the Brillador Mine near the town of La Serena, Coqumbo province at a cost of $190,000. The 98% acid will serve the needs of the company's 40-tpd leaching plant, and the excess will be sold to the other small leaching plants located in the same province.

Discovery and development of an up-to-now unknown low-grade, (just below



Exterior view of Ozark Mahoning Plant

STANDARD-HERSEY countercurrent rotary concentrate dryer

FLUORSPAR CONCENTRATE DRIED TO ALMOST 0% MOISTURE BY A

STANDARD HERSEY ROTARY DRYER

The Northgate, Colorado plant of Ozark Mahoning Co. produces Acid Grade Fluorspar exclusively. Since their flotation concentrator went into production in October of 1952, output has increased to the point where their Standard-Hersey dryer *is now operating at 150% rated capacity.*

The filter cake, produced in Denver equipment, is transported by screw conveyer to a stacking belt for stock piling and sampling, or directly into the 6′ by 50′ Standard-Hersey countercurrent rotary dryer. Moisture in the concentrate is reduced by the dryer from 12-14% to approximately 0% for shipment.

The dryer is lined throughout its length with refractories, as is the dryer furnace. Exhaust gasses at 350°F. pass through a cyclone type dry dust collection system with a balanced airlock arrangement. The temperature of the discharge product is 450°F. Semi-automatic burner controls provide efficient operation of the dryer unit.

The unusually large diameter of the dryer was selected to minimize the velocity of the gas stream through the dryer thus reducing concentrate dust loss to an estimated 1-ton of concentrate per 24 hours.

The engineering staff of the 52 year old Standard Steel Corporation has thousands of successful dryer applications to draw on in solving your problems. Over 30 types of dryers are available to fill almost every drying need in the chemical and food fields.

STANDARD STEEL CORPORATION

General Offices & Plant, 5060 Boyle Avenue, Los Angeles 58, California

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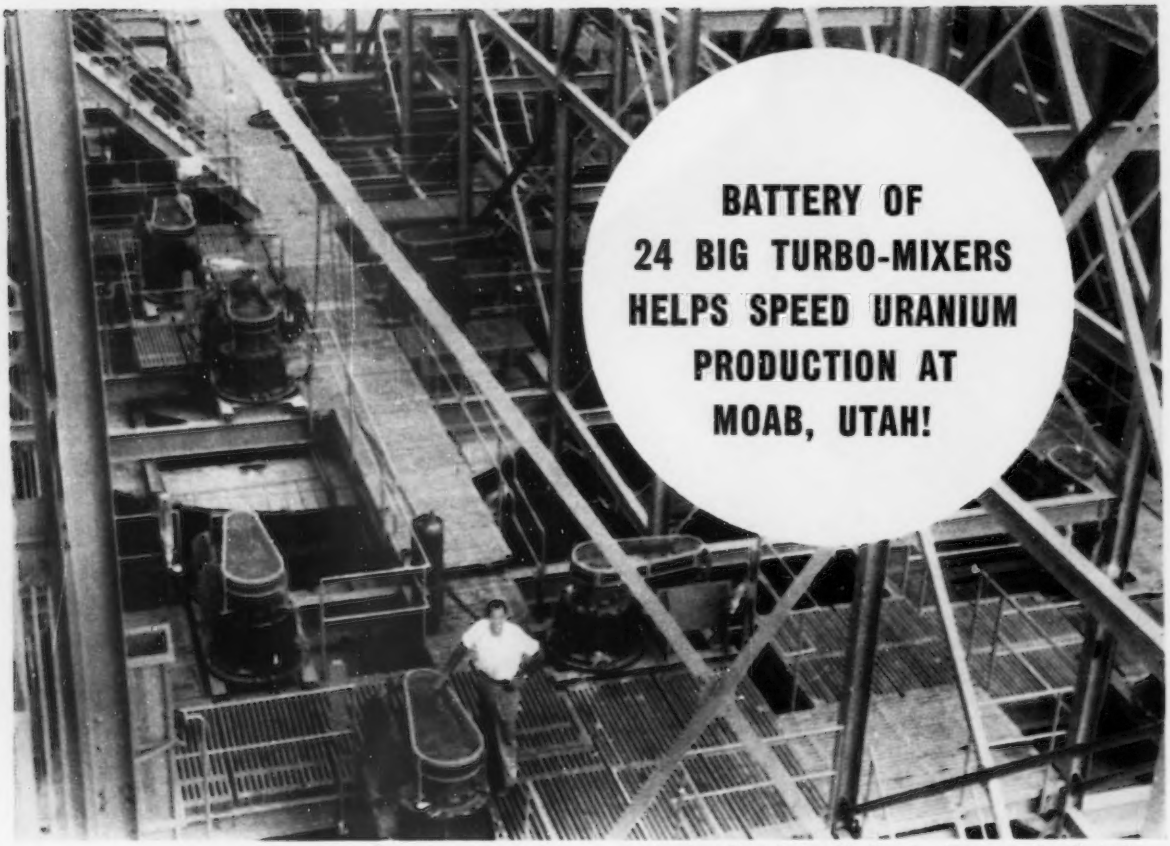

BATTERY OF 24 BIG TURBO-MIXERS HELPS SPEED URANIUM PRODUCTION AT MOAB, UTAH!

Leaching Plant designed by Knowles Associates, New York City

Each Turbo-Mixer can be vertically removed as a unit for rapid spare-assembly replacement

Uranium Reduction Corporation operates some of the largest leaching units in the industry—eight of their ten big leaching tanks depend on three 30-H.P. Turbo-Mixers per tank to suspend over one and one-half million pounds of uranium ore on a continuous flow basis. These Turbo-Mixers have operated without interruption since the plant went "on stream." Other Turbo-Mixers in the Metallurgical field are handling slurries of 75% to 80% solids. Turbo has specialized in this type of mixing for over 30 years. We'll be glad to tackle your difficult suspension problems or to conduct laboratory or pilot scale demonstrations with your observers.

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FOR DETAILED INFORMATION AND USEFUL DESIGN DATA, SEND FOR THE FOLLOWING BULLETINS:

Please send me the following Turbo-Mixer Bulletin (s):

_____Minerals Processing Bulletin

_____Side Entering Propeller Mixer Bulletin

_____RDC Extraction Column Bulletin

_____General Turbo-Mixer Bulletin

"A drop in the bucket!" The constructions shown here by Tom Weichel, Okonite's chief mining engineer, are just a random sampling of the cables that Okonite has developed for mining operations. More than likely, Okonite has available right now the exact cable you need—in terms of toughness, flexibility, capacity, resistance to oils, acids, alkalies, mine water and high heat. If not . . . we know how to build it!

Here's how we add value to your cable dollar

Behind these cable constructions are service records that prove the extra long life of Okocord portable cables in the face of continual high-speed reeling, rock falls, run-overs and constant dragging over mine floors and around sharp corners.

Longer cable life means lower operating costs . . . reduction of costly work stoppages . . . greater utilization of expensive equipment. Truly, Okocord represents money in the pocket for any mine operator.

Here's how Okonite assures maximum value for your cable dollar:

1. By the use of materials developed in 80 years of making the finest cables.
2. By constant research to find even better materials and constructions.
3. By intimate, first-hand knowledge of mining problems and conditions.
4. By self-imposed standards for manufacturing and testing that are more exacting than the industry requires.

There is an Okonite quality cable for your shovels, drills, shuttle cars, continuous miners and other equipment. There are Okonite specialists ready and willing to help you in the planning or installation stages. And there is a brand new booklet full of valuable hints on picking the right cable constructions for your all-important power or control circuits. Write for free Bulletin EM-1117—"How to choose insulated cable"—to The Okonite Co., Passaic, N. J.

Visit Booth G-49 at the Bluefield Coal Show and discuss your cable problems with Okonite's Tom Weichel.

where there's electrical power . . . there's **OKONITE CABLE**

6128

Chile (*Continued*)

2% Cu) flat-dipping deposit in the Andacollo gold camp is permitting the small flotation mills of this camp to produce 650 tons of 25% concentrate per month which are being bought by the Mining Credit Bank for smelting at the Paipote Copper Smelter.

Mining Credit Bank and the Paipote Smelter have jointly undertaken to convert into a 300-tpd copper flotation mill part of the Juan Soldado cement mill where previously the low-grade limestone was up-graded for cement making. Mill will be able to handle the low grade ores from neighbouring old copper camps such as La Higuera, Lambert, Tambillos, Pejerreyes and the sulphide ores from the Brillador Mine. Bank will also sell to the miners under easy terms of payment air compressors, rock-drills, steel and trucks.

Chile, through the Copper Department, has just closed a deal with the USSR to sell 10,500 metric tons of 5.8 mm wire and another 3,500 metric tons to Western Germany. These two transactions were not carried out directly with the two above-mentioned countries but through Mr. Otto Shilling, a Swiss banker and industrialist.

The contract placed recently with a West German consortium by the Chilean Empresa National de Fundiciones provides for construction of a copper smelter with an initial capacity of 30,000 annual tons blister. The plant will have an annual input capacity of 150,000 tons.

The second and third phase of construction is scheduled to boost capacity to 80,000 tons blister and input capacity to 450,000 tons.

The fob value of the equipment to be supplied by the German consortium for the first phase is $6-million, for which deferred payment has been arranged. The consortium is led by Kloeckner Industrieanlagen, Duisburg.

At a later date the Chilean company plans to add an electrolytic refinery and a copper sulphate plant to the preparation plant.

. . . by fitting the drill bit and carbide to your needs

Brunner & Lay blast-hole drill accessories have always been made in a wide range of types and sizes, with job-fitted carbides, to meet exactly your needs. This means more footage per grind, with drill speeds up and footage costs down. For details, call our nearest plant. Brunner & Lay, Inc., 9300 King St., Franklin Park, Ill. *76 progressive years.* Plants & warehouses: Philadelphia, Asheville, Birmingham, Dallas, Albuquerque, Denver, Los Angeles, Sacramento, Portland, Ore., Montreal.

Brunner & Lay 4-point Intra-Set affords easier starting—and following—with the use of smaller size bits. No attachments to lose, bind or stick. Only Brunner & Lay offer both 4-point and chisel types with bit and steel as one piece. Ask for Bulletin 1S756.

Carbon or alloy drill rods. Serviced and fabricated at our many plants. Ask for catalog #756 on your company letterhead, stating your position.

Widely used #400 and #200 carbide Rok-Bits for medium long hole drilling with light drifters and ⅞" hex. alloy Brunner & Lay sectional steel. Write for information on this, and other, money-saving applications.

Brunner & Lay taper-socket Rok-Bits. No threads to strip. Strong, power-saving union. Easily assembled and knocked-off. Save rod handling, reduce breakage. All tapers and popular sizes.

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BOLIVIA

It was officially announced that a vice president of Wah Chang Corp., owner of Texas Smelter and other concerns, is coming soon to Bolivia in order "to get in touch with Mining Corporation of Bolivia (Corporación Minera de Bolivia) and the Mining Bank (Banco Minero) to see to means and ways for the coordination of mutual interests."

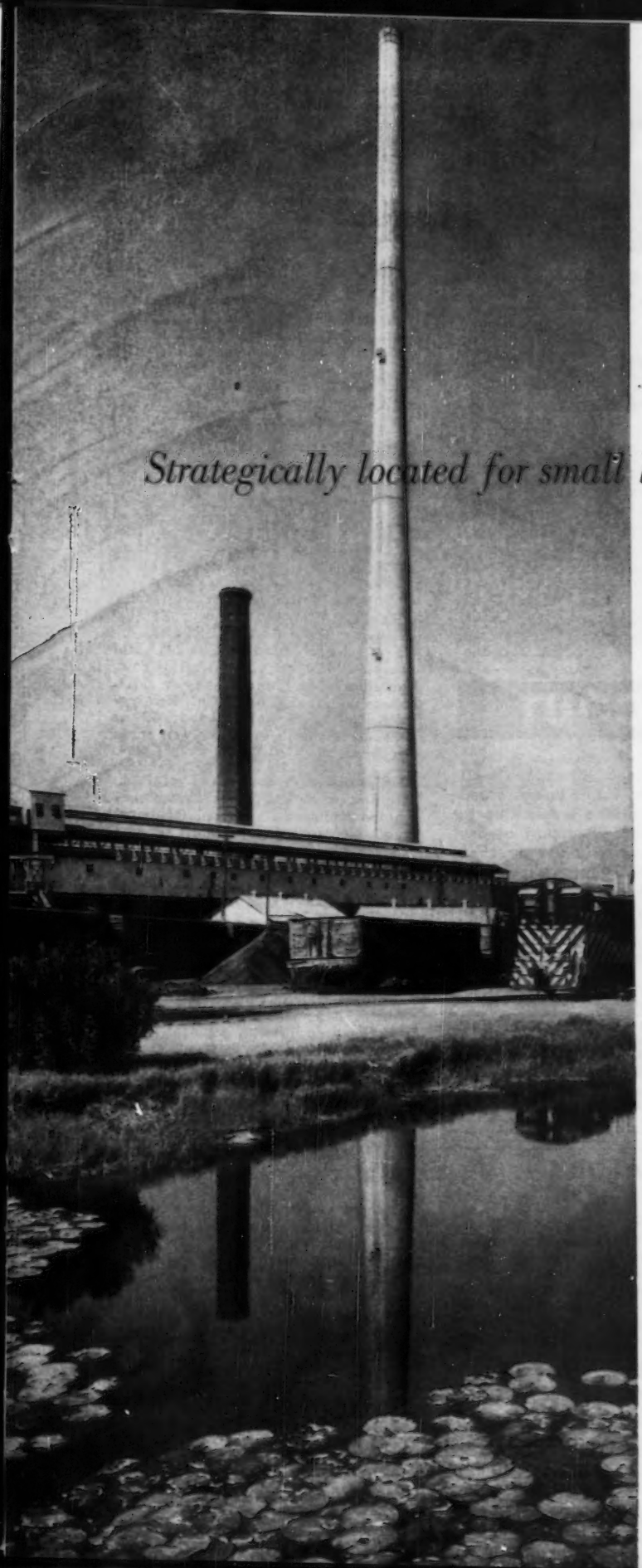
IN AUSTRALIA

The Australian Federal government will carry out extensive diamond drilling operations at the Maranboy tin field in Northern Territory in a determined bid to secure large-scale tin production in Australia.

Government Bureau of Mineral Resources will be entrusted with the task as a result of an agreement concluded between the Government and a group of mining companies including United Uranium N. L., King Island Scheelite and Loloma Gold Mines. These companies have acquired the allegedly rich Maranboy tin field and in November last cut a tin lode at a depth of 125 ft.

Production of lead concentrate and zinc concentrate is being cut more than previously planned and the average reduction in output is now expected to exceed 15%. In spite of the publicity given to the planned 10% cut it is understood that the actual reduction is considerably in excess of the 10% rate. McGraw-Hill World News understands that New Broken Hill Consolidated Ltd.'s recent output figures show a fall of about 14% in lead concentrate output and 19% in zinc concentrate. Zinc Corp. Ltd.'s fall is as much as 23% for zinc concentrate and 15% for lead concentrate.

First shipments of ilmenite to the United States were made by Western Titanium N. L. from Western Australia. Ilmenite market is still described as "quite satisfactory" by leading Australian producers and several contracts with overseas buyers, including those in the U. S., are



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Tacoma, Washington
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at above locations
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UNDERGROUND
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YOU'LL CUT EXPLORATORY COSTS IN HALF WITH THESE DIAMOND CORE DRILLS

SUPER PIONEER

Here's a rugged compact light-weight drill you can take anywhere. The Super Pioneer eliminates guesswork by giving a true core sample to depths of 100' or more. Designed for one-man operation, drills at any angle in all formations. Gasoline-powered drill and pump weigh just 35 lbs. each.

Basic kit includes drill, pump, and accessories. Rods and bits additional.

$885.00 FOB Spokane

SUPER SCOUT

This all-new air-powered one-man drill sets up and tears down in minutes, eliminating lengthy traffic tie-ups. Hand operated hydraulic feed supplies drilling pressure up to 1500 lbs. Anchor column provides drill support at any angle with or without back wall. Drills in any direction or at any angle to depths up to 100' with exceptionally high core recovery. Weighs just 85 lbs.!

Complete unit includes drill, hydraulic feed, anchor column, hoses, 50' of rods, core barrel, starting barrel, collar pipe, tools, and storage box.

$1175.00 FOB Spokane Diamond bits additional

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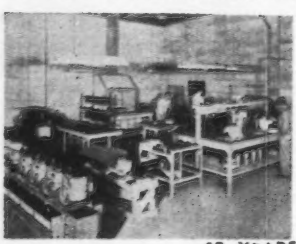

The Booth Company maintains a fully equipped testing laboratory for the purpose of evaluating all types of ore treatment processes, establishing flow sheets, and providing plant design data. A competent staff of metallurgical, chemical and mechanical engineers, representing more than 30 years of ore treatment, equipment design and plant design experience, welcomes the opportunity to lend its experience to your problems. Write today for Bulletin No. 564 for further information.

— 40 YEARS OF ORE TREATMENT —

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Australia (*Continued*)

in the final stages of negotiations.

New production records were established in Australia in 1957 and the annual output of 330,000 tons of lead means that Australia has displaced the U. S. as the top world lead producer. Zinc production in 1957 was 295,000 tons, another Australian production record.

South Australian government says that the iron ore search outside leases held by BHP Co. Ltd. has disclosed about 30-million tons of high-grade ore. BHP Co. Ltd. will receive the right to take out fresh leases over a strip of land 42 miles long and six miles wide close to their present leases.

IN THE PHILIPPINES

Because of a serious and almost unprecedented water shortage on Cebu Island in February, production at the Toledo mine of Atlas Consolidated declined sharply during the month. Mill treated 219,243 tons in 20 working days, lowest tonnage for over a year. Millheads averaged 0.68% Cu. Recovery came to 1,329 tons Cu and 652 oz Au. All shipments of copper were made to Japan.

Phelps-Dodge Products Corp. of P. I., the first copper drawing mill established in the Philippines, delivered the initial production order of 400 miles of bare copper wire weighing 66,000 lb to the Manila R. R. Copper for manufacture was purchased from Atlas Consolidated from its production at the Toledo mine.

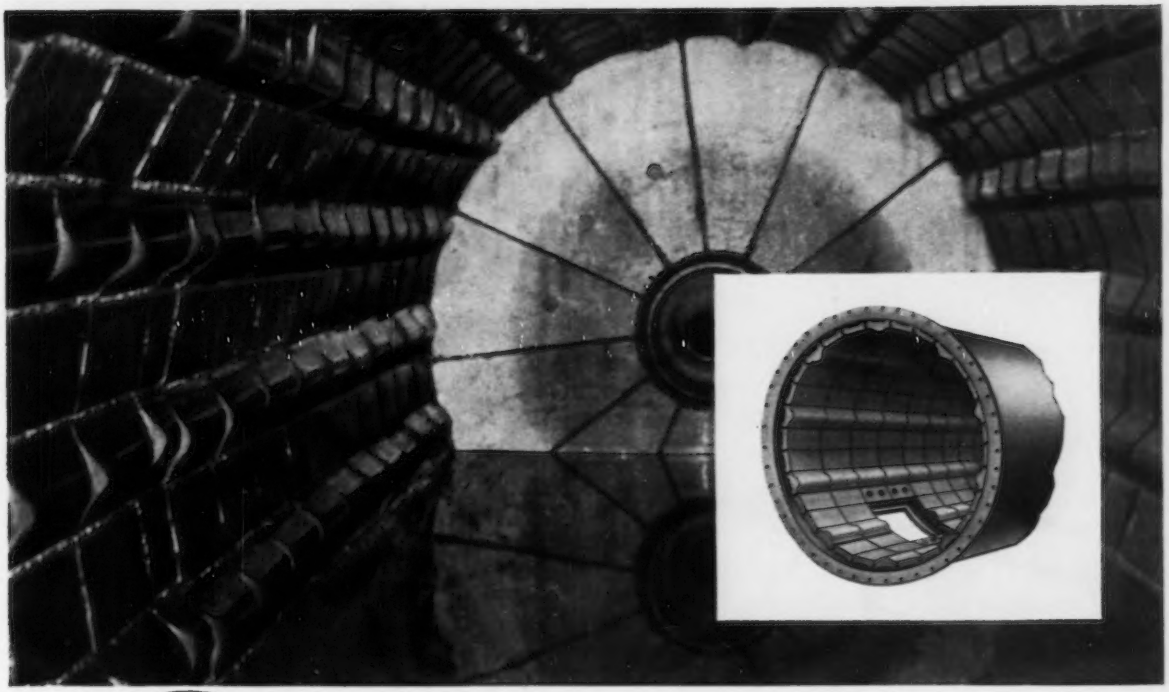
Santo Tomas, a new copper-gold property controlled by Philtex Mining Corp. has announced that Nippon Mining Co. will purchase its concentrates. Mill will start production late in May. George T. Scholey is general manager of Philtex and Henry A. Brimo is president.

Lepanto Consolidated milled 33,230 tons in February, producing 4378 tons of concentrates with estimated content of 1059 tons Cu and 3639 oz Au. Concentrates averaged 24% Cu and 0.8 oz Au per ton. Copper recovery was 95% and gold 78%. Average mill heads were 3.36% Cu and 0.14 oz Au per ton.

Northern Luzon Mining and Industrial Co., operators of three groups of manganese claims in Buguey, Cagayan, has shipped ore recently to Japan with a high manganese content. Company expects to increase output to 500 tons a month. Ore appears especially suitable for use in flashlight batteries and depolarizers.

IN AFRICA

Since the beginning of the year Union



8 Reasons Why You Should Standardize with B&W Universal Liner Plates

Better Performance with Lower Costs—Same Casting Fits All Mill Sizes

B&W Tube Mill Liners reduce capital, time and labor costs. Consequently, they reduce the cost of the material ground. Here are eight reasons why:

1. Lower Initial Costs—standardization eliminates chiller and pattern costs.
2. Longer Life For Liners—better quality control on a mass production casting, utilizing permanent molds, results in uniform wear. Ideal size for uniform chill and heat-treatment.
3. Longer Life for Different Applications—this is assured by selection of proper materials. Design is suitable for either chilled irons or wear steels.
4. Reduced Costs in Both Direct Labor and Outage—installation time is less because small size and weight of castings allows them to be handled easily, without cranes and with less fatigue for workers.
5. Reduces Costs in Storage Space—because small castings stack easily, little storage space is required. One design of casting interchangeable for all size mills also simplifies records.
6. Reduced Costs in Liner Inventory—standardization is possible because one design fits all diameters of mills. Standardization means quicker unloading and storage.
7. Reduced Costs on Breakage Claims and Delays for Replacements—small castings are rugged and almost impossible to break by handling. Large castings of hard, brittle irons sometimes break in shipment.
8. Reduced Costs in Determining Most Efficient Wear Patterns—you can get wear profiles consisting of all lifter ribs or all flats from the same castings, as well as a combination of both including straight or spiralled lifter pattern.

Liners are supplied in two nominal thicknesses, 1½" and 3" with 1½" high lifters. Castings are 6" wide x 12" long. Positive seating of small castings on mill shell means less breakage of castings under operating conditions. For additional information on B&W Universal Tube Mill Liner Plates write The Babcock & Wilcox Company, Process Equipment, Barberton, Ohio.

S-471

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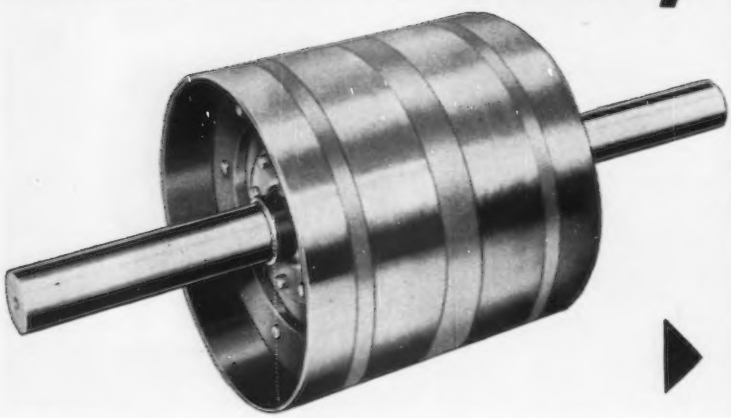
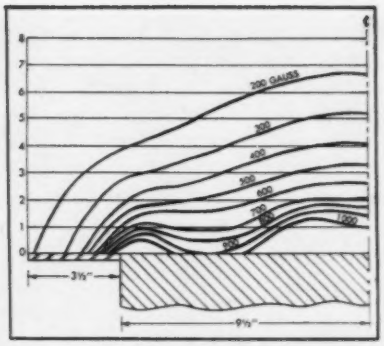


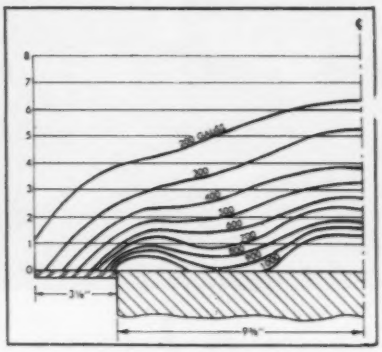
- Outperforms conventional permanent magnet pulleys
- Equals deep-field power of electromagnetic types,

but...

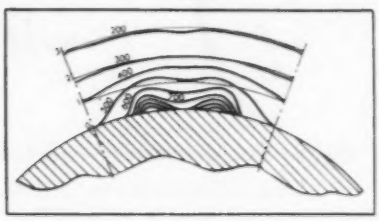
- costs nothing to operate
- free from power failures
- eliminates rectifier
- needs no maintenance
- eliminates heat
- impervious to moisture
- radial design boosts holding efficiency



GAUSS PATTERN: SIZE 18 x 24 ELECTRO MAGNETIC PULLEY. AT 80% OF RATED CURRENT



GAUSS PATTERN: SIZE 18 X 24 INDOX V PERMANENT MAGNETIC PULLEY



GAUSS PATTERN: SIZE 18 X 24 ALNICO V PERMANENT MAGNETIC PULLEY

Never before could you expect tramp iron protection like this with a permanent magnet pulley! Performance of the new Stearns Indox V pulley is equal to that of electromagnetic types—yet it has all the cost-saving advantages of permanent magnet design

Indox V is the amazing *ceramic* magnet material used exclusively in Stearns pulleys. It is the heart of an entirely new magnet assembly with *radial pole design*. This feature produces a strong magnetic field that blankets the conveyor burden, pulls out troublesome tramp iron far more efficiently than old-style permanent magnet pulleys.

The Indox V pulley needs no energizing current. It costs nothing to operate, requires no maintenance, ignores power failures.

Stearns Series "410" Permanent Magnet Pulleys — and Stearns "710" for deeper conveyor burdens — are available in standard widths from 12 to 48 inches, and in diameters of 12, 15, 18, 20 and 24 inches. Stearns engineers will help you select the right Indox V Permanent Magnet Pulley to match your conveyor system. Call your Stearns representative, or write for free literature.

*Patents Pending

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A DIVISION OF THE INDIANA STEEL PRODUCTS COMPANY

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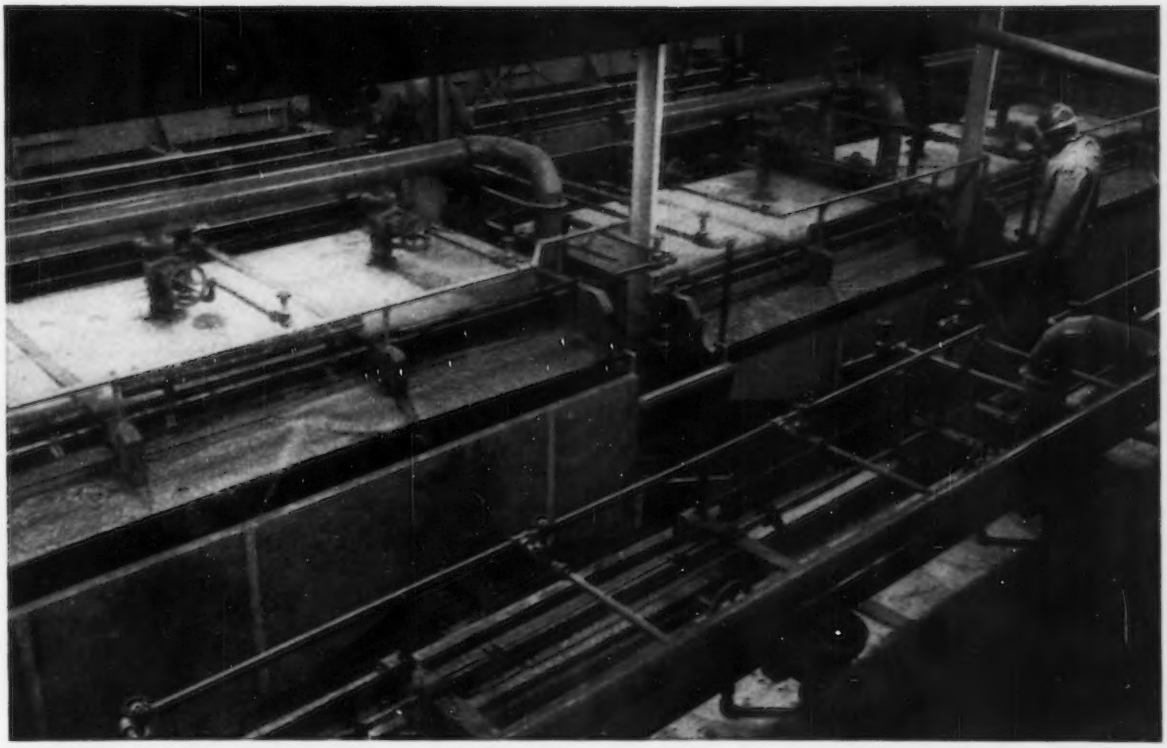
Free Booklet *describes the new Stearns Series "410" and "710" Indox V Magnetic Pulleys. Write today for Bulletin 1021-D.*



MODERN PIONEERS—The Cleveland-Cliffs Iron Company in Michigan is one of the pace setters in the conversion of low grade, nonmagnetic iron ore into a high iron content product. Pamak fatty acid is being used in the flotation phase of beneficiating the specular hematite material on the Marquette Range of Michigan.

PAMAK® FATTY ACID BOOSTS ORE RECOVERY

New techniques for processing low grade ore are the big news in the mining industry. Key to the process is beneficiation, and Pamak fatty acid has already demonstrated its usefulness as a collector in the beneficiation of such ores as Spodumene, Barite, Ilmenite, Fluorspar, Manganese oxide ores, and Scheelite.

Efficient recovery methods require a fatty acid of consistent high purity. Pamak is manufactured at Hercules' modern fractional distillation plants at Franklin, Virginia and Savannah, Georgia and also available in Canada. It is produced under continual quality control supervision to provide you with a fatty acid that is consistently more than 90% pure.

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Industrial Chemical Department

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PT86-1

AT COFFEE HOUR, Mrs. Olaf Jenkins (center) chats with Mrs. Fred Lohse and Mrs. J. K. Brooke (right). Left are Mrs. W. H. Crutchfield Jr. and Mrs. J. M. Basham.

Hunt predicted that the market for columbium would be 12-60 tons a month if the mill product cost $50 a lb, 50-250 tpm at $15 a lb, 70-350 tpm at $10 a lb, 100-500 tpm at $6 a lb and 400-2,000 tpm at $4 a lb. Based on titanium and zirconium processing costs, he made the estimate that columbium would cost $30 a lb to produce at rate of 5 tpm, $4.90 at rate of 50 tpm, $3.20 at rate of 1,000 tpm.

X-Ray Fluorescent Analysis

A feature of the Geology Division sessions was a talk on X-ray mineral analysis techniques by R. E. Wood, senior scientist, instrumental analysis, Kennecott Research Center, Salt Lake City.

Said Wood: The X-ray fluorescence technique offers "a simple, rapid and efficient method of elemental analysis for both exploration and control work in the mining field. Method is non-destructive, which means that expensive drill core samples or polished sections may be chemically analyzed without loss or alteration. In the assay of mill products this technique offers a means of reducing the lag time between sampling and assay, thus offering a means of improving process control. Potentially, this technique offers a sensing organ for ultimate automation of ore milling processes."

Assaying ore samples by X-ray fluorescent costs about half as much as wet chemical analysis, Wood said, and it takes only a few minutes.

He said you can expect accuracies within plus or minus 5% of the amount present if you perform the X-ray analysis on samples after they have simply been reduced to uniform mesh size. If you grind them to a fine particle size, and add an internal standard by grinding and mixing, by chemical solution and reprecipitation or by fusion with a low atomic number flux to yield a glass button, you can expect accuracies within 1-2%.

Industrial Mineral Use

Industrial Minerals Division heard a talk prepared by Emo D. Porro and Moses I. Levitsky, Thermo Minerals, Inc., Menlo Park, Calif., on "New Raw Material Requirements for High Temperature Ceramics and Electronics Components." They pointed out that minute impurities can affect strength, electrical, fluorescence, magnetic, catalytic surface and optical properties of materials. They said Thermo Materials, which is concerned with production of ferrites, used in electronic equipment, has to know composition of the raw materials to thousandths of 1%, and "present-day raw material suppliers are usually not in a position to supply such material or, even worse, they are unable to supply an accurate analysis of the material they have." They reported that they found variations in ferrites as large as one thousandfold because of minute differences in manganese dioxide or manganese carbonate content of the raw material being tested.

They suggested that firms interested in supplying raw materials to "the ever-increasing market generated by technology-based industries" develop the skills:

1) To meet specifications or at least accurately state the composition of the materials they wish to sell. This usually means a new set of controls on raw materials, new equipment for clean-up of raw materials, far closer controlled material handling and processing systems and excellent quality control.

2) To realize that the day of "typical" analysis is over. Therefore, they must work very closely with the user to develop the specifications which are most suitable for both parties.

3) To provide more detailed and accurate analysis of the material they wish to sell. Purchasers will pay the added cost if the analysis is accurate.

4) To band together to set up uniform standard and report all analyses on a common base.

Personnel Relations

In a talk prepared by Charles F. Park Jr., dean of the school of mineral sciences at Stanford University, (and delivered in his absence by Dr. Eugene Paul Pfleider, head of mineral engineering department at the University of Minnesota) the mining industry was urged to "follow examples set in the petroleum and physical metallurgy industries" and establish more facilities for fundamental research. Lack of research opportunities is one of the main reasons that top-notch personnel are attracted to professions other than mining, he said.

"We need to establish incentives and support in our fields, especially in mining, and we also need to polish these incentives with just a little of the old time glamor that has recently been taken over by the atom splitters and sputnikers," he added.

A young assistant professor of metallurgy at Stanford, Robert A. Huggins, received a top AIME award at the conference—the Lansing Medal, given annually to the man under 30 which the AIME selects as having most promise in his chosen field, was presented to Huggins by E. M. Barker, chairman of the San Francisco Section. Huggins, 29, is author of several technical publications in physical metallurgy. His special interests include kinetics of solid state reactions, high temperature deformation of metals, and solid state imperfections.

Another award was presented to Dr. Foster Hewlett, geologist with the U. S. Geological Sservice, Menlo Park, Calif. He received the AIME Legion of Honor in recognition of his 50 years' membership in the Institute.

Next Pacific Southwest Mineral Industry Conference will be held in Los Angeles in 1960.

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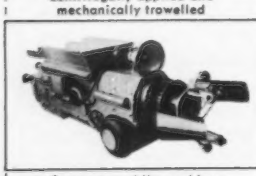

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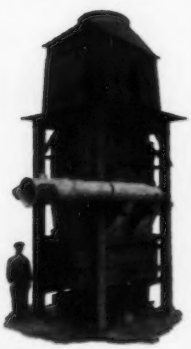

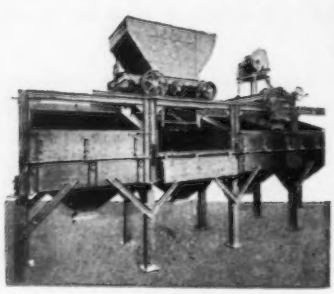

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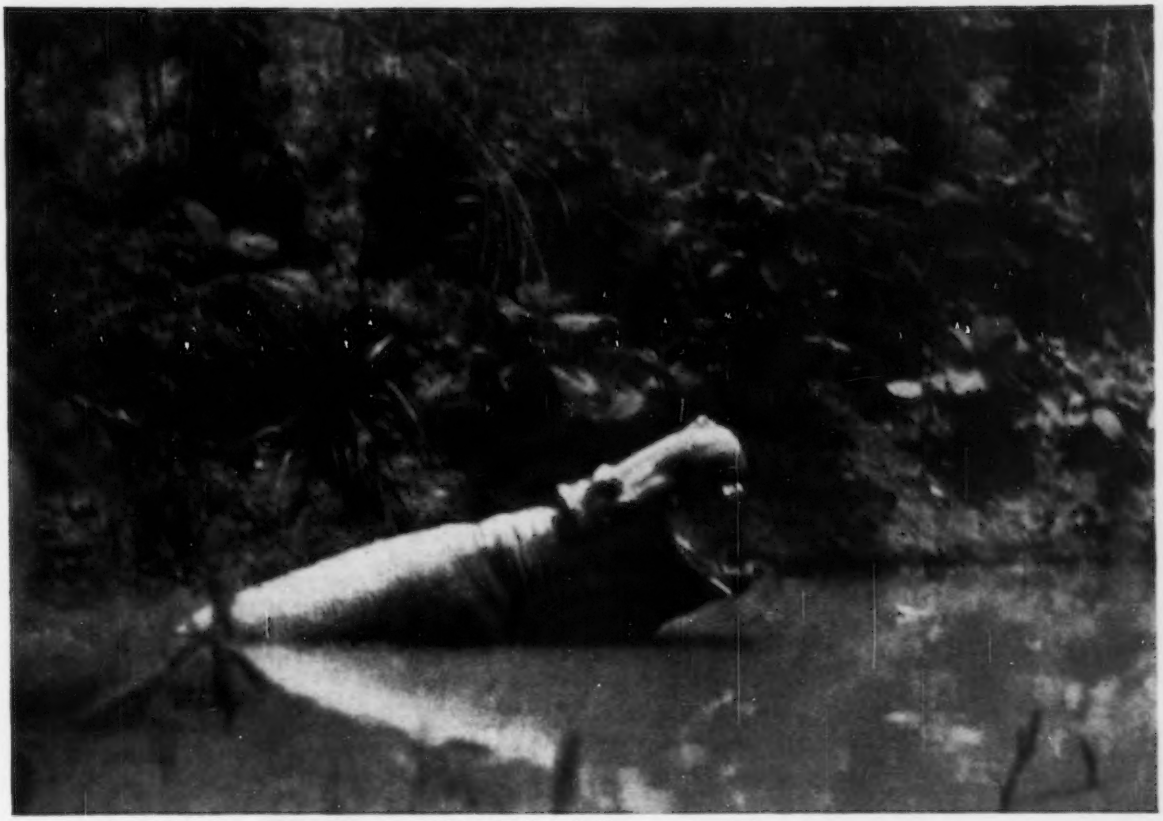
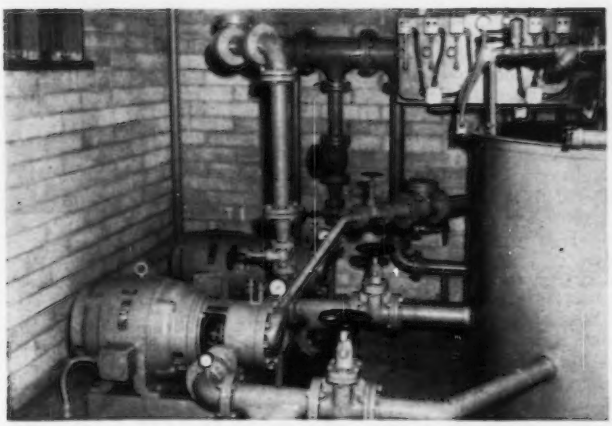


A hippo surfaces with a cavernous yawn—powered by water from F-M pumps shown below.

From butterflies to hippopotami

F-M pumps make animals "live"



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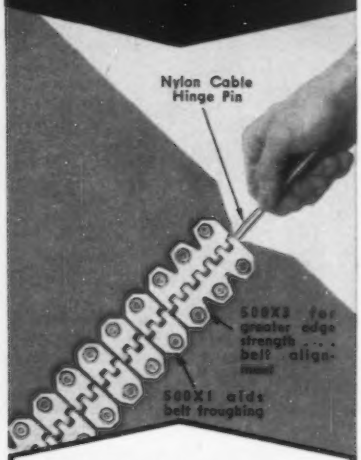

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Africa *(Continued)*

Corporation Ltd. has shown an active interest in the Ladybrand-Clocolan district of the eastern Free State. Company has acquired the mineral rights over a large block of farms in this area near the Basutoland border.

It is reported that Rand Mines Ltd., who have a six months' option on a portion of the Fort Victoria (Southern Rhodesia) lithium deposit, have been engaged in an active drilling programme. Reserves of the whole area are estimated to be in the region of 8-million tons.

Natal Water Court has granted an order to Ferroalloys Ltd. which will permit the exporting of ferromanganese. Order authorizes the company to use up to 5,000,000 gallons of water daily from a river in the province. A producing firm, Associated Manganese, will supply the plant with ore from the Transvaal.

First aerial exploration of a new area in West Africa using the airborne magnetometer is now nearing completion in Sierra Leone. Upon completion 4,000 square miles will have been surveyed.

These airborne geophysical studies are being undertaken for the Department of Overseas Geological Surveys on behalf of the Sierra Leone government. Canadian Aero Service Ltd., with headquarters in Ottawa, is performing the survey. Derby Aviation Ltd., Derby, England, is providing the pilots and aircraft, an Anson Mark I, twin-engine plane.

Until recently a great deal of secrecy—applied by the Union government at the insistence of the U. S. and British atomic energy authorities—has cloaked the activities of South African producers of uranium.

Lately, however, the lid has been lifted to reveal the Union standing alongside the U. S. and Canada in status as a producer and, furthermore, with the largest proved reserves of this strategic material in the world.

Disclosure of much detailed information previously kept secret indicates that if uranium were to be sold on a world free market when the present contracts for its purchase expire in nine years, the Union would be well placed to compete with other producers. When all of the 29 mines approved to produce uranium are in full production the yearly output will be well ahead of the present figure of 5,000 tons.

Known South African ore reserves are estimated to exceed 1.1-billion tons. Uranium content of these reserves, which in some cases include surface reserves in the form of slimes from the gold reduction process in earlier years, is estimated at about 370,000 tons—130,000 tons more than the uranium content of the estimated Canadian reserves (225,000,000 tons) and 220,000 more than the estimated reserves in the U. S.

In the meantime several South African uranium producers will seek permission to expand their plant capacities when the forthcoming discussions with the United Kingdom and U. S. Atomic Energy Authorities take place.

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PRODUCTS Over 40 silicates (liquids, solids, hydrated and anhydrous powders). You'll get the right one for your particular ore.

USES Dispersing agent, depressant, surface conditioner; for metallic oxides as well as non-metallic minerals.

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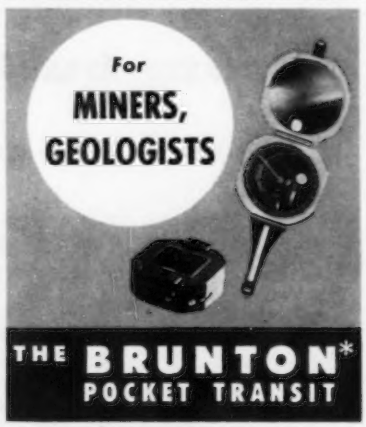

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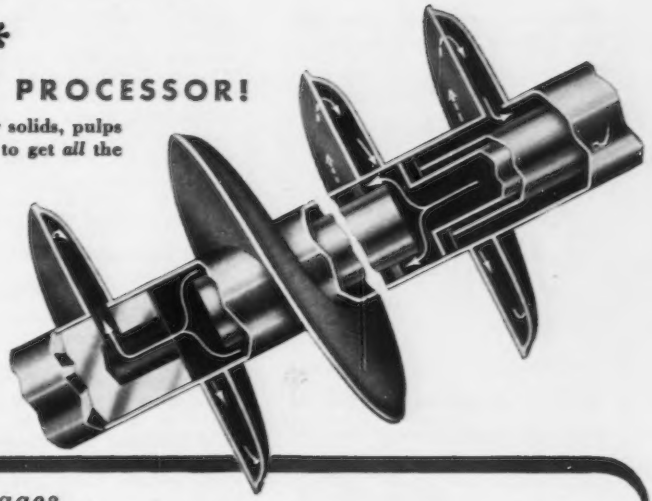

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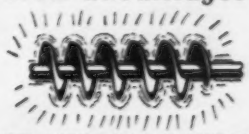
ITS APPLICATION FLEXIBILITY is almost unlimited. It cools, heats, or dries. It handles granular solids, pulps, pastes, slurries and fluids with equal ease. Its heat transfer agent can be water, refrigerant, hot oil, Dowtherm, steam or other liquids or vapors at any of a wide range of temperatures. It cools materials in ranges from 1800°F to 0°F. It heats and dries with hot oil to 600°F...with Dowtherm to 750°F...with steam to 150 lbs. per sq. in. pressure.



THE LARGE HEAT-TRANSFER SURFACE saves space — HOLO-FLITE requires as little as 1/5th the space of other heat-exchange equipment of comparable capacity. Moreover, a more complete heat transfer is effected, resulting in more uniform processing.

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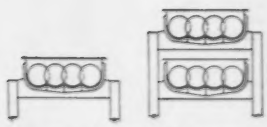

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Basically the HOLO-FLITE consists of one or more flights of hollow-bladed screw conveyors. The product to be processed moves through a trough housing the conveyor screws. The heat-transfer fluid circulates through the hollow blades and shafts of the conveyor. The product is constantly rotated into, around, under and over the blades and shafts through which the heat-transfer fluid is circulating, assuring quick, uniform heat passage between the two mediums — *as the product is continuously moved along in a bulk-flow without interruptions!*

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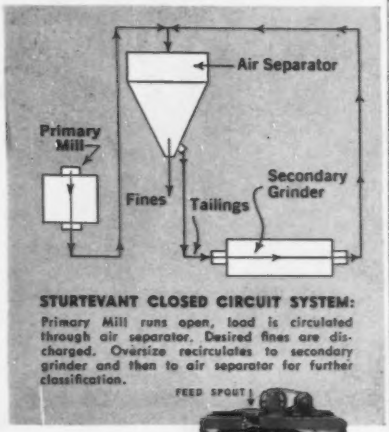

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Sturtevant Air Separators Can Lower Power Costs Up To 50%

Production capacity impossible in single-pass grinding results from using Sturtevant Air Separators in closed-circuit grinding systems. They are of proved advantage in all secondary reduction processes.

Fines pass through grinding mills unhindered, are classified, and the oversize returns for further grinding. Grinding mills are free to perform at top efficiency, their output frequently increased as much as 300% and power costs cut up to 50% (documented by 30 years of Sturtevant air separation experience in the cement industry).

Precise Classification; Circulates Loads of 800 tph

Sturtevant Air Separators circulate production loads of up to 800 tph. Simple adjustments make possible counter-action between air currents and centrifugal force to the point where a product of almost any desired fineness may be collected while coarser sizes are rejected.

A 16 FT. STURTEVANT, for example, took a feed rate of 800 tph, containing only a small percentage of desired fines, and delivered 30 tph 90% 200 mesh, recirculating the oversize through the grinding circuit. (In the cement industry, Sturtevant units deliver up to 60 tph raw cement fines, 40 tph finished cement fines.)

Nine models available, diameters from 3 to 18 ft. For more information, request Bulletin No. 087. (Bulletins also available on Micronizers, Blenders, Crushers, Grinders.) Write STURTEVANT MILL CO., 101 Clayton St., Boston, Mass.

IN EUROPE

Confirmation that the Siberian Plateau is likely to become one of the world's leading suppliers of diamonds is the latest discovery in the Jakutien area of diamond fields richer and larger than the fields now being worked in the Belgian Congo and in Ghana.

Discovery of new rich deposits to the southeast of the area in addition to the mines already being worked to the east of the area means that 90% of all the diamonds mined in Russia will come from the Jakutien fields alone.

Russia has started developing one of its richest iron ore deposits, according to Soviet News. The deposits, in the River Yenesei Basin, will yield many thousands of millions of tons of iron ore, the newspaper reports.

A mine has been opened up in the area and a dressing plant built in Khakassia to supply iron ore to the Kuznetsk Iron and Steel Works.

Further deposits of iron ore, about 4,000 million tons, have been discovered in the Angaro-Pitsky Basin, in the lower reaches of the Angara, Soviet News says. Russia hopes to build ore-dressing plants and a large iron and steel works there soon.

Deutsche Gold-und Silber-Scheideanstalt (DEGUSSA), Frankfurt, has developed a procedure to separate uranium from uranium-phosphate minerals like autunite by sodium-carbonate extraction as described in a recent preliminary patent DAS 1 023 748.

Degussa's new procedure uses the formation of magnesium-ammonium-phosphate in carbonate solution to obtain a phosphate-free uranium salt concentrate from the solvent after adding acids.

In the procedure, magnesium salts and ammonium salts—ammonium carbonate might even replace sodium carbonate—and traces of crystalline magnesium-ammonium-phosphate for immediate crystallization are added to the carbonate solution and form the complex phosphate, which takes other impurities such as SiO_2 and colloid iron hydroxide also into the precipitate. After filtration the uranium can be precipitated by acids.

Main advantage of the procedure is the individual treatment of minerals of given uranium and phosphate concentration. Uranium and phosphate precipitates for instance can be obtained by neutralization of the first carbonate leach of minerals with small uranium content. In a second carbonate treatment a concentrated and phosphate-free uranium salt yield by using the separation procedure. The secondary effect of impurity-absorption of the magnesium-ammonium-phosphate is another advantage of the method.

IN ASIA

U. S. and German production know-how is being employed to mechanize a vast lignite mining project at Neyveli, India.

A 200 million ton lignite deposit is

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WEIGHTOMETER

The Merrick Weightometer provides a continuous, automatic, accurate weight record at any designated point in the mill, while material is in motion on conveyor. It weighs without interrupting conveyor service. Applicable to any size belt conveyor, horizontal or inclined. An accurate and dependable means of keeping constant check on production.

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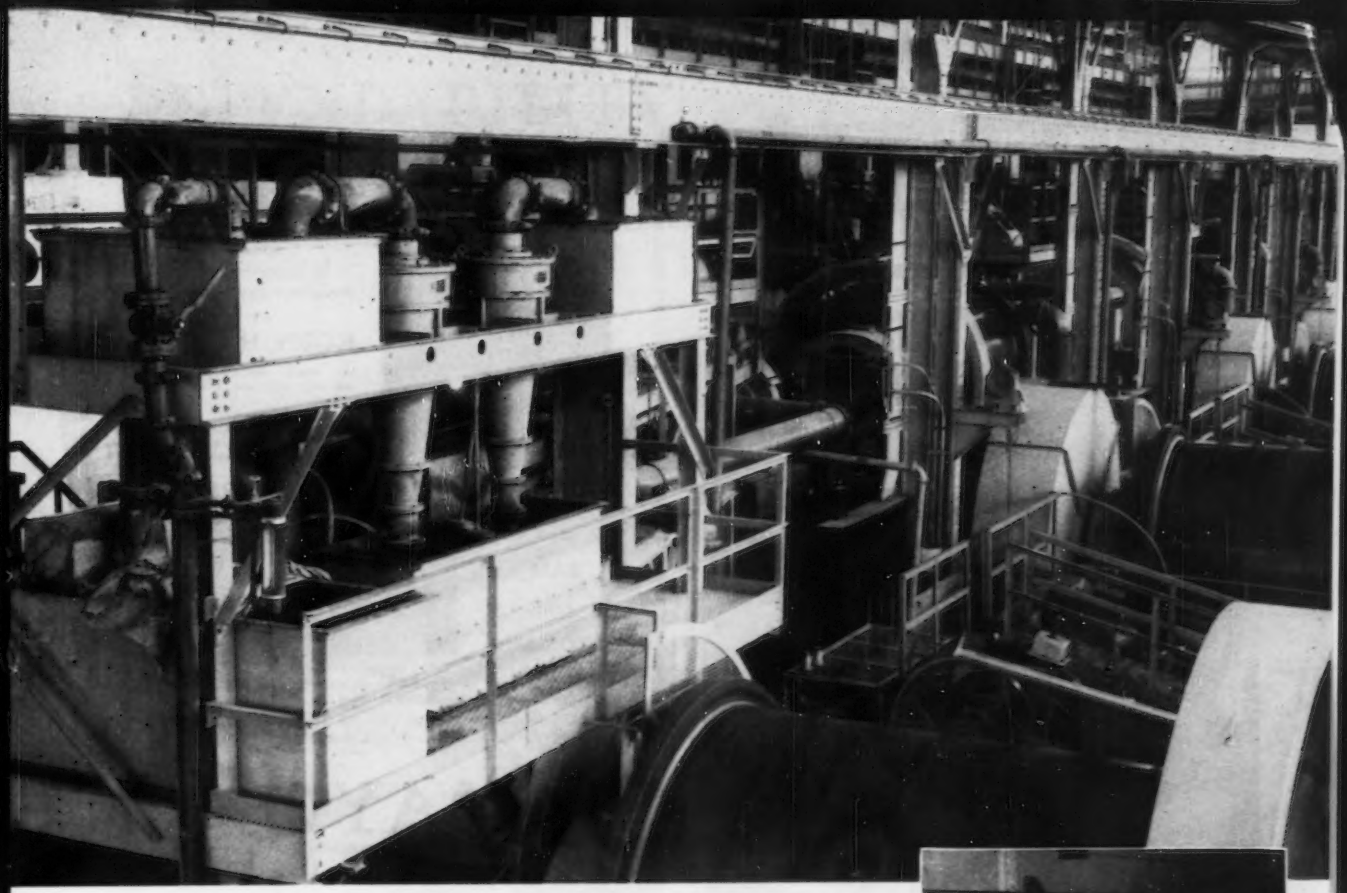

Two model D20 Krebs Cyclones in closed circuit with a 9' x 11' ball mill

Krebs Cyclones in closed circuit and for sand-slime separation

Two model D20B Krebs Cyclones on the sand-slime separation

Homestake Mining Company uses Krebs Cyclones for closed circuit classification with their new grinding unit and for the sand-slime separation. The cyclone, specially designed for each objective, are low in cost and easy to operate. The new classification techniques give sharper cuts and better percolation rates. Hundreds of model D20, D20B and EE20-9B cyclones are in service and all are operating with the original molded replaceable body liners and long sweep inlet nozzles. Many of these have now handled over a million tons of ore per cyclone.

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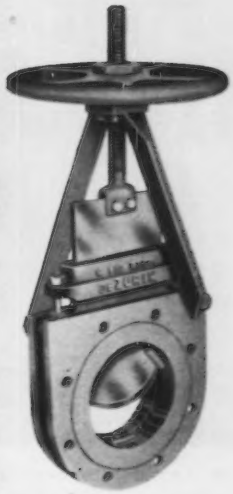

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Asia *(Continued)*

being tapped at Neyneli to stimulate industrial expansion in Southern India. A cut 180 ft deep, 1,200 ft wide and 6,000 ft long will be made to remove overburden of sandstone, gravel, sand and clay, exposing the first section of lignite.

Thirteen miles of 48-in. conveyor belting has been built by Goodyear Tire & Rubber Co.'s Wolverhampton, England plant to mechanize the stripping operation. Portable belt conveyor systems, designed by Germany's Fried Krupp, will be used to remove 12- to 18-million tons of overburden a year. It is expected that the belt conveyors can be converted to lignite mining operations by 1961. Mine is scheduled to produce at an annual rate of 3.5-million tons.

Lignite in the Neyveli deposit has a thermal value of about two and one-half tons to one ton of good coal, but the cost of mining two and one-half tons of lignite at the automated Neyveli mine is expected to be 40% less.

According to Indian Minister for Industries, the government of Uttar Pradesh state (north India) and the Birla brothers have finalized arrangements to set up an aluminium plant at Pipri, near the site of the U. S. engineered Rihand dam in this state.

This Rihand aluminium project, says the Minister, will have a target production capacity of 20,000 tons per year and the plant is expected to go into production in 1960-61 with a production capacity of 10,000 tons. The project's cost, he adds, might range between $31.5-million and $42-million, of which the foreign exchange requirements would amount to around $16-million.

As earlier reported, the Birla brothers were on the lookout for U. S. capital and know-how to push through this project, but according to their Bombay headquarters, the French firm of Messrs. Pechiney now has come forward with "positive indications of interest."

Pechiney's experts also are reported to be in India right now exploring the main bauxite deposits in the country—mainly near Mettum (Madras state)

The Japanese government has decided to extend to India a yen credit totalling $8-million to help develop iron ore deposits in the Rourkela area of Orissa state (east India).

A spokesman of the Japanese Embassy here told this correspondent that "Our government's step is designed to cooperate with the U. S. in developing Indian iron mines with money from President Eisenhower's Special Fund." An official note to this effect is to be handed over to Mr. Ellsworth Bunker, U. S. Ambassador in India.

Meanwhile, the Indian Government has withdrawn a previously imposed restriction on the export of high-grade manganese ore, which, from July 1957 to June 1958 was to force quota holders of manganese ore to use at least 40% of the quotas issued to them for export of manganese ore containing 42% Mn and below. This policy now has been reviewed and the restriction withdrawn enabling shippers and mine owners to export ore of all descriptions.

A 40-year-old dredge with a history steeped in California gold is slowly taking shape at Batang Berjuntai, where Pacific Tin Consolidated Corp. is opening a new lease with an approximate total capital investment of M$10-million.

But despite its age the 4,000-ton dredge, when completed, will undoubtedly be one of the largest and most modern in Malaya. It is being completely overhauled and rebuilt, and is expected to be in operation during the third quarter of this year.

Batang Berjuntai project is the biggest that Pacific Tin had ever undertaken, said the president, Norman Cleaveland.

Mr. Cleaveland has a particular interest in seeing the dredge working once again, for the hull and much of the basic machinery came from the Californian gold fields, and was built under the direction of his father, the late N. Cleaveland.

"I was present," he said, "when the original dredge was launched in 1918. It was one of the biggest dredges in the world at that time, and I remember the tremendous impression it made on me."

The dredge was working on gold until as late as five years ago, when it went into temporary retirement.

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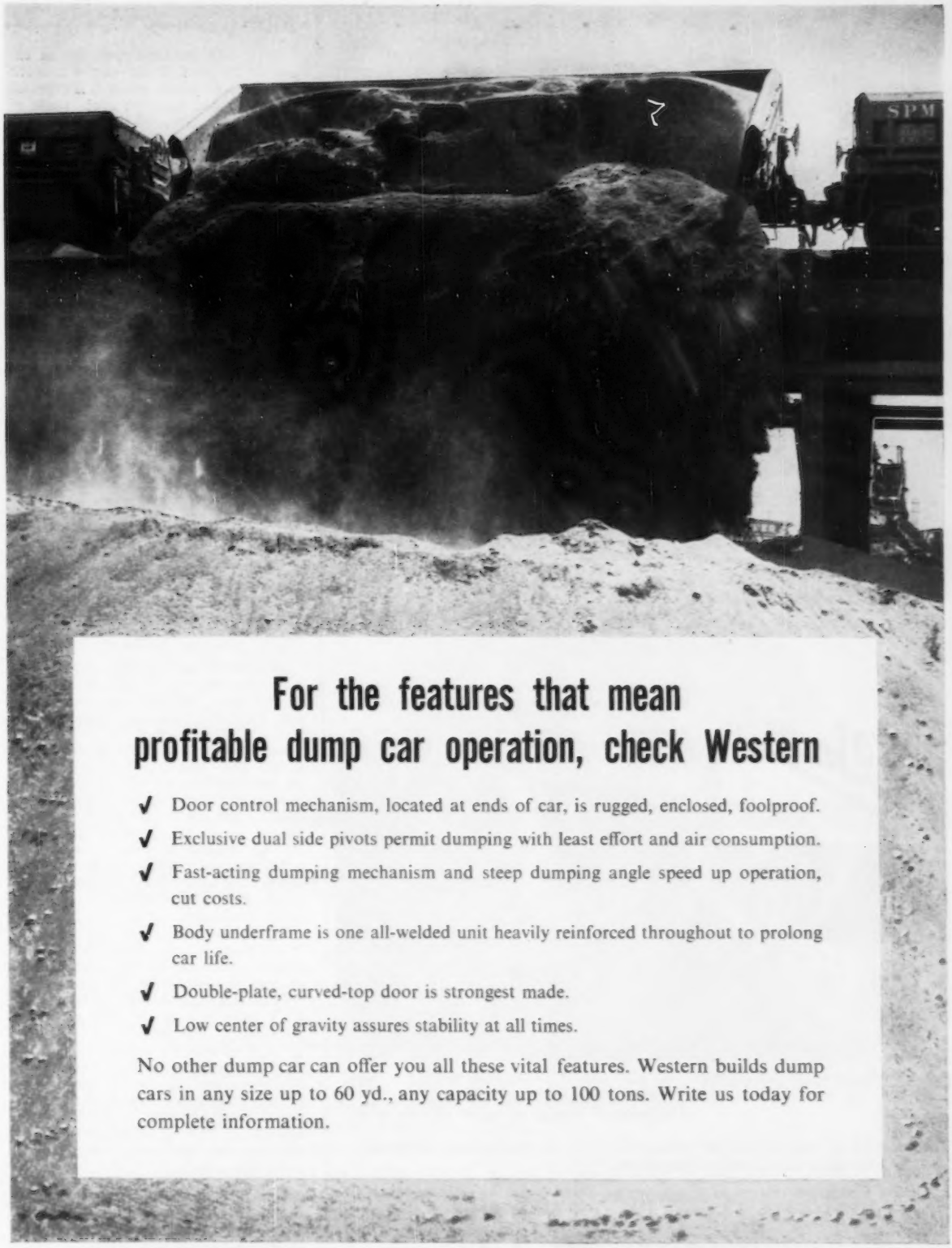

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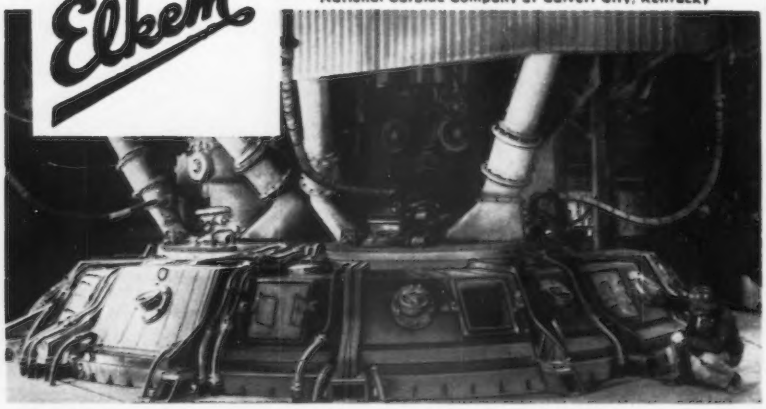

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Asia (*Continued*)

Now, with an anticipated life in excess of 20 years, it will be put to work at Batang Berjuntai, where it is expected to treat about 6-million cubic yards of material per year.

Mr. Cleaveland said the dredge was designed to dig 100 ft, and to maintain a 15-ft bank along the face.

Treatment plant will handle 900 cubic yd per hour over the jigs. There will be 56 flow lines of rougher jigs, 16 of secondary jigs and four of tertiary.

Dredge will start off with a second-hand line of 18 cubic ft buckets, which will be replaced in due course by buckets with a capacity of 20 cubic ft.

Dredge will be equipped with a stacker with a 54-in. rubber conveyor belt. Stacker will be used primarily for handling stripped material, which will be dumped directly from the buckets into the belt.

Malayan production of tin concentrates in February amounted to 3,559 tons. At the end of the month there were 71 dredges, 462 gravel pump mines and 58 other tin mines in operation making a total of 591 active tin mines.

Reduction of five in the number of operating dredges refers to the dredges of Tekka-Taiping Ltd., Kinta Kellas Tin Dredging Ltd., No. 1 Kampar Malaya of Southern Kinta Consolidated Ltd., Hongkong Tin Ltd. and Killinghall Tin Ltd.

At the end of February, 36,446 persons were employed in mining, of which 31,534 were employed in tin mining and 4,912 in mining other than for tin.

Russia claims that its tin production is higher than that of Malaya and that its entire production was barely sufficient to meet the country's own demands.

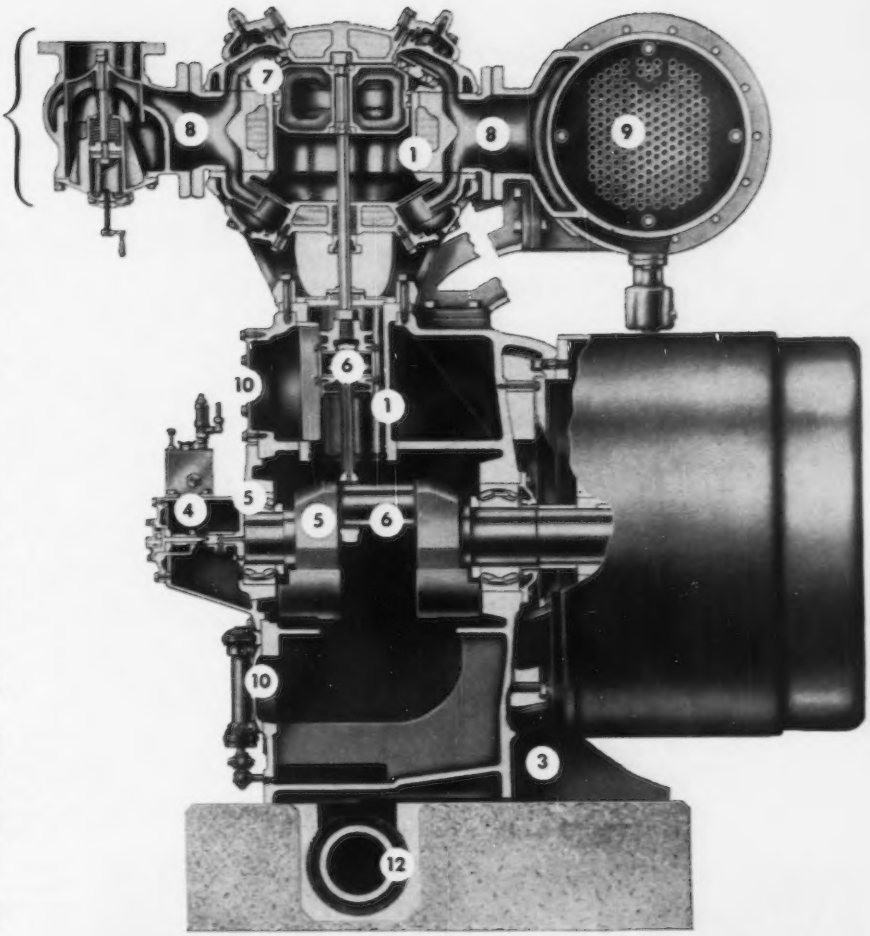
This statement was made by Mr. Nicolai P. Firubin, Deputy Minister of Foreign Affairs, Moscow, who headed a 19 man Soviet delegation to the fourteenth session of the Economic Commission for Asia and the Far East recently concluded.

In an interview with McGraw-Hill World News, Firubin denied that Russia dumped tin on the London market in an attempt to depress world prices. He claimed Russia sold only 5,000 tons in the London market last year at prices prevailing at the time.

Asked whether his country would consider participating in the International Tin Agreement, if invited to do so, Firubin categorically stated that Russia would have no part in the ITA. He accused the ITA of strangling producer countries for the benefit of Western capitalists.

Despite Peking radio's accusations of Japanese sabotage and the U.S. Government's dickerings, Communist China-Japan trade is moving along.

Japanese liaison office set up between the Red Chinese trade mission (now visiting Tokyo) and the Japanese steel industry representatives is adamant in refusing to disclose the progress of the conference. But it has announced indi-



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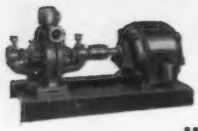

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Asia *(Continued)*

vidual contracts signed between the Chinese trade mission and each individual firm.

Under the plan, Japan will export some 90,000 tons of steel sheets including galvanized and some 30,000 tons of steel pipes during the April-June period. This will come out of the 150,000-tons total of steel goods during the initial year of the five-year agreement.

Malaya's sorely tried tin mining industry was dealt another blow by the announcement in Tokyo that Japanese importers had concluded agreements to import Chinese tin.

Last year Japan was one of Malaya's best "geographical" customers for tin, importing 6,744 tons from Singapore and Penang.

These imports formed 9½% of total Malayan exports. One advantage that Chinese tin has over Malayan is that it is considerably cheaper, the reports from Tokyo stating that the contract prices have been concluded at nearly £20 per ton below Malayan prices.

Prices are said to be £706 per metric ton fob China for the metal of 99.9% Sn and between £698 and £700 for 99.56 and 99.57% Sn.

Japanese importers say if Communist China continues to supply tin to Japan regularly at such low prices, the country may become a large tin supplying source for Japan.

Announcement of the contract was made by the Koyo Bussan Co., a Japanese firm trading with Communist China.

Radio Peking reports that Communist Chinese prospectors have found magnetite deposits in Sinkiang, Red China's great western province bordering the Soviet-Union.

A layer of magnetite deposits, 20 to 40 meters thick, has been found in the eastern part of Sinkiang, with reserves sufficient to warrant the construction of an iron and steel center.

The iron area is 30 kilometers from the new Lanchow-Sinkiang Railway Line —which is being extended to connect with the Trans-Siberian Railway—and geological prospectors there are reported to have discovered another deposit about 100 kilometers away.

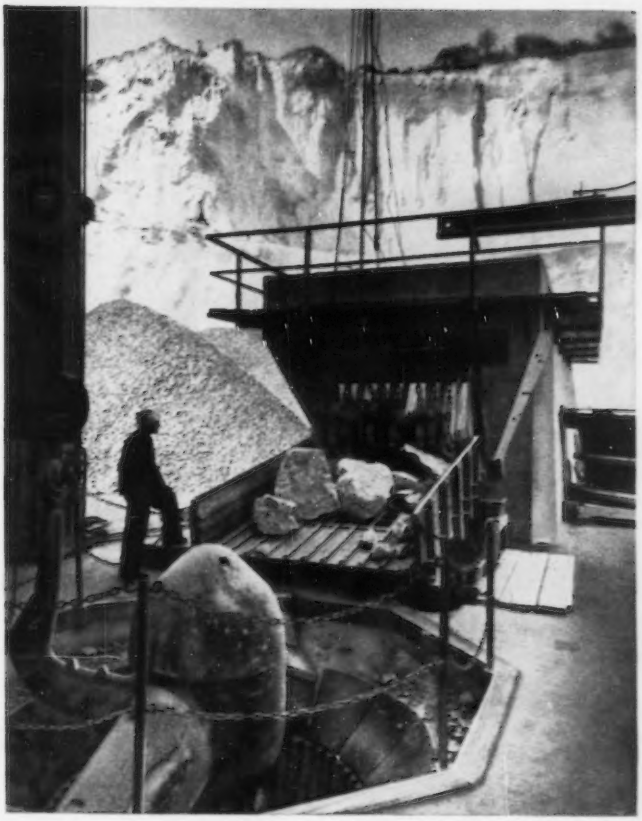
This new discovery makes a total of four rich iron ore deposits that Chinese Communists claim to have found in the Sinkiang region in the past few years.

A leading producer of scientific equipment and weapons in Tokyo announced it plans to develop monazite mining in Thailand with the aid of Japanese government.

Komatsu Seisakujo—Japan's prewar giant arms manufacturer—which was prospecting in the Malayan peninsula last year brought back about 10 tons of monazite ore samples early this year for testing.

Test proved to have a "satisfactory" thorium content and the company received greenlight from the Japanese government to commercialize the project.

Company is reported to have reached an agreement with a Thai mining firm on the prospecting work.



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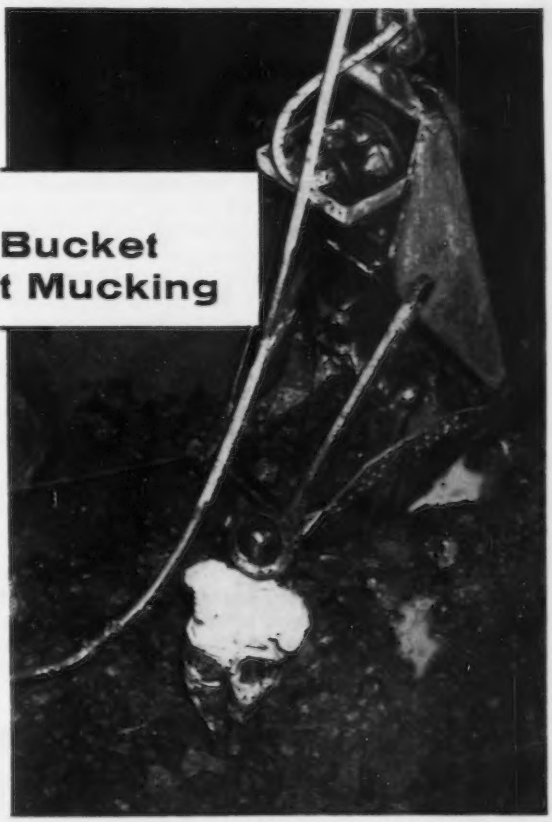

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For descriptive bulletins or further information, contact your nearby Blaw-Knox Bucket dealer or the factory.

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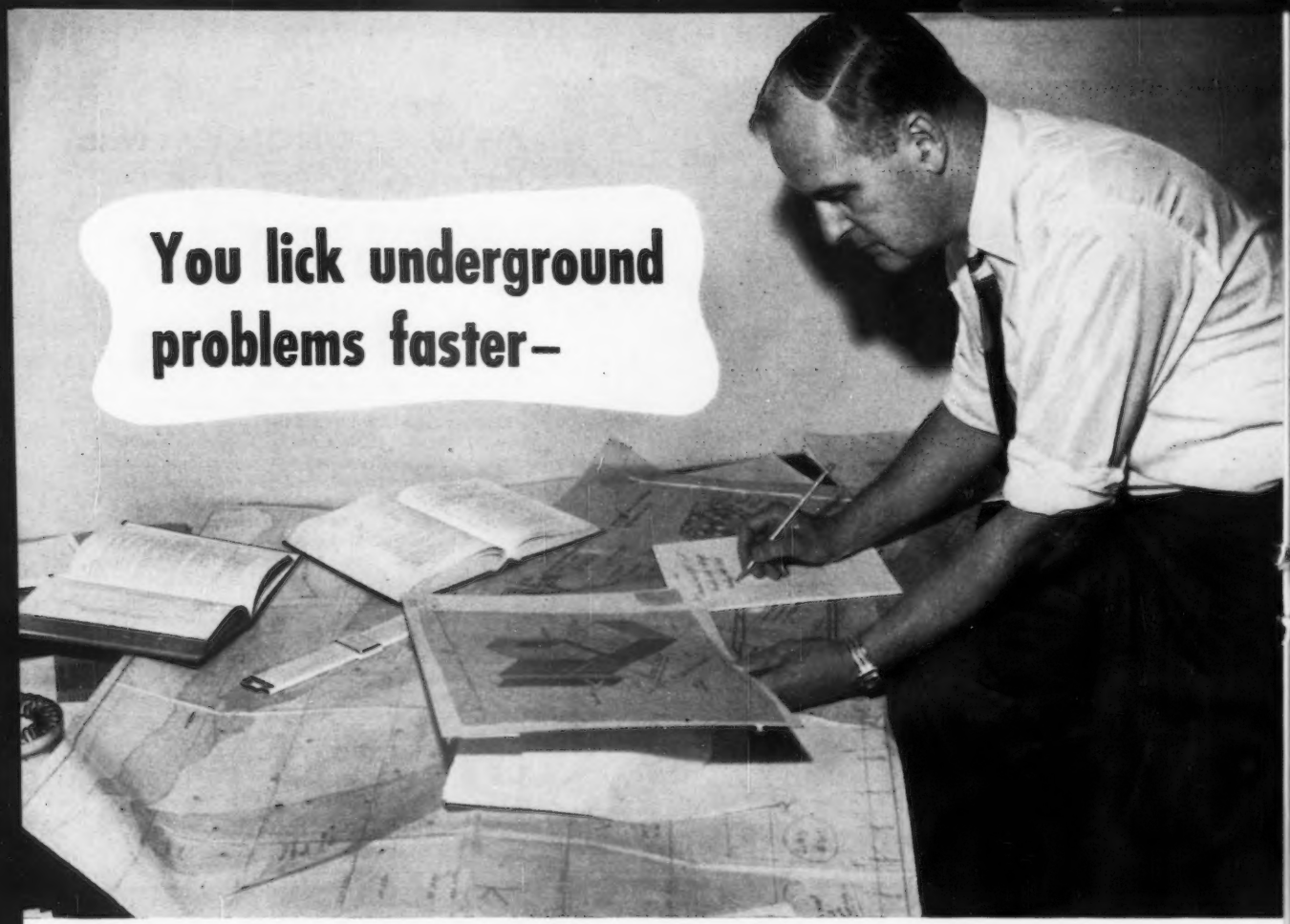

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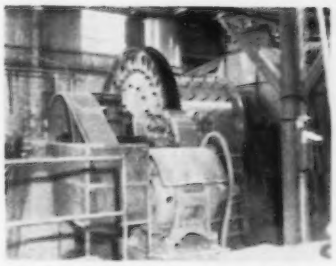

7 x 6 Allis Chalmers Ball Mill

LOCATED CENTRAL IDAHO

ALL ITEMS EXCELLENT CONDITION

COMPLETE WITH BOLTED STEEL BUILDING AS SHOWN

Flotation Plant

BUCKETS—Slusher
28—30" Pacific S.usher
17—30" Slusher

BLOWERS
2—TM8 Cogeus Ventair, 15 HP
6—TM7 Cogeus Ventair, 10 HP
2—Jeffrey Aerodyne Midget, 5 HP

CARS—Mine Oore
32—33 cu. ft. Ajax Type Side Dump, 18" gauge.
6—23 cu. ft. Ajax Type, Side Dump, 18" gauge.
36—37½ cu. ft Ajax Type, Side Dump, 18" gauge.
13—100 cu. ft. Gable Bottom, 18" gauge.

COMPRESSORS
1—2000 cfm Worthington, w/400 HP Motor
1—500 cfm Chicago Pneumatic, w/100 HP Motor

DRILL, Diamond
1—HS-15 Sullivan Diamond Drill, complete.

HOISTS, Tugger and Slushers
1—F113 Joy Tugger, Air
24—15NNIG, I. R. Slusher, Electric
3—AAF211 Sullivan Slusher, 15 HP Electric
19—D-211 Sullivan Slusher, 7½ HP Electric
1—HEE Gardner Denver, Slusher Air
1—FF211 Joy Slusher, 10 HP Electric
1—E111 Joy Tugger, Air

HOIST, Mine Shaft
1—40 HP Sullivan, C-111 Single Drum, 40 HP Motor

LOCOMOTIVES
1—2½ Ton Diesel, 18" gauge.
5—4 Ton Jeffrey Type Battery, 18" gauge
2—Universal Tramaire, 181 gauge
1—7 Ton Plymouth Diesel, 18" gauge
1—2½-3 Ton Jeffrey Battery, 18" gauge
3—1½ Ton Atlas, Type J. Battery, 18" gauge
4—1½ Ton Mancha "Little Trammer," 18" gauge.

BALL MILL
1—7 x 6 Allis-Chalmers, 250 HP

CRUSHERS
1—15" x 24" Traylor Jaw, 50 HP Motor
1—2' Symons Cone Crusher, Standard, 30 HP Motor
2—4" x 6" Massco Jaw, Lab. Type

CLASSIFIERS
1—36" x 19'3" Wemco Spiral, w/drive
1—48" x 20'3" Wemco Spiral, w/drive

CONVEYORS
1—30" x 177" Hewett-Robins, steel structure, magnetic head pulley.
1—18" x 95' Hewett-Robins, steel structure.
1—18" x 47' Belt Conveyor, steel structure, 1½ HP

CONDITIONER
1—5' x 6' Wemco Conditioner, complete

FEEDERS, Ore
1—30" x 6' Apron Feeder, 5 HP Motor
1—24" x 23' Belt Type, Gearmotor Drive

FEEDER, Reagent
2—±18 Deco Cone Reagent, Dry
2—±12 Deco Cone Reagent, Dry
8—E-I Clarkson, Wet

FLOTATION MACHINES
1—2000 gm. Wemco Laboratory
1—2 cell, 36" Fagergren
4—3 cell, 44" Fagergren
2—2 cell, 44" Fagergren
2—Unit Cell, 44" Fagergren

FILTERS
1—6'—3 leaf Eimco
1—6'—2 leaf Eimco

ORE BIN
1—250 Ton Steel Ore Bin

PUMPS, Sand
2—1¼ Wemco Sand, 5 HP Motor
1—3" Wemco Diaphragm, Simplex
1—2" Wemco Diaphragm, Simplex
2—2" Wemco Sand, 5 HP Motor
1—3" Wemco Sand, 15 HP Motor

PUMP, Vacuum
1—14 x 8 Oliver, 15 HP Motor

PULVERIZER
1—9" McCool, Laboratory

LAMPS
185—MSA, R4 Cap Lamps, complete with rack and charger

MUCKING MACHINES
7—6D9H Gardner Denver, 18" gauge

PUMPS
1—200 HP Pomona Deepwell, 3 stage
1—75 HP Pomona Deepwell, 8 stage
1—3RVH30 Ingersol Rand, 220/440 Volt
5—2RVH15 Ingersoll Rand, 220/440 Volt
6—±35 Ingersoll Rand Sump Pump
1—60 HP Aurora Centrifugal, 2 stage
1—30 HP Byron Jackson, Deepwell

RAIL
10 Tons—20± Rail, Relay
48 Tons—30± Rail, Relay
18 Tons—40± Rail, Relay

SHEAVE BLOCKS
137—8" Pacific, RB

SAW
1—±500 Ingersoll Rand, Steel Cutoff
2—Mall Air Powered Chain, Model 1P12

ENGINEERING EQUIPMENT
1—Berger Transit
1—Gurley Transit

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SAMPLER
2—GECO Automatic Sampler

SIEVE SHAKER
1—Tyler Ro-Tap, 8"

TABLES
2—8A Wilfley Lab Concentrating

THICKENER
1—20' x 8' Wemco, Steel Tanks and drive
2—±12 Deco Cone Reagent, Dry
8—E-I Clarkson, Wet

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